



NEXTCYCLE  
MICHIGAN

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# GAP ANALYSIS 2023

NOVEMBER 2023

PREPARED BY:

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**EGLE** MICHIGAN DEPARTMENT OF  
ENVIRONMENT, GREAT LAKES, AND ENERGY

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# EXECUTIVE SUMMARY

The following 2023 Gap Analysis defines areas of critical need in state-wide materials management as Michigan continues its long-term transition to a circular economy, decarbonization, and climate adaptation. Legislation passed in 2022 codifies a state-wide goal of 45% waste diversion by 2030 and establishes a supporting regulatory framework and organizing structure. This, along with the continued support of the Renew funding established by the legislature late in 2018, acts as a proverbial “carrot and stick” to move the state forward in sustainable materials management<sup>1</sup>. But that legislative leadership is only a piece of the pathway to success. The following report highlights current gaps in the materials management system that need attention, commitment, and resources from across the spectrum of Michigan’s stakeholders – residents, communities, businesses, industry, and institutions, as well as state government – to build the circular economy of Michigan’s future.

Much has been accomplished since the passage of the Renew funding in 2018, with over \$771 million in investment supporting growth of Michigan’s circular economy tracked across the state. This has been leveraged by approximately \$29 million of investment from grant funding through EGLE Recycling Market Development and Recycling Infrastructure Grants<sup>2</sup>.

Despite these investments, Michigan still disposed of 8.2 million tons of MSW in 2022. So, while this progress is notable, and the foundation for success is beginning to take shape, there is still considerable work to accomplish with special focus needed in these critical gap areas. The following key observations provide overall guidance in addressing where Michigan’s recovery programs, infrastructure, and economy are today and what actions the state could take to achieve targeted diversion goals:

- Access to diversion services and infrastructure across the state is weak and/or non-existent in disadvantaged communities both urban and rural, as well as certain sectors like multi-family housing and commercial establishments of all sizes.
- Food waste, a very large portion of the still landfilled waste across the state, represents a major opportunity for diversion that is untapped, with financial and greenhouse gas reduction benefits left unrealized.
- Comprehensive drop-off infrastructure for residents and small-to-medium commercial generators is missing across much of the state, making it impossible to deliver diversion solutions for a wide range of materials that need to find their circular economy pathway: from traditional recyclables like glass, plastic and paper to more challenging materials like electronic waste, household batteries, carpet, mattresses, and plastic films and flexibles.
- Funding to both capitalize and operate the equipment, facilities, and services needed to provide this diversion infrastructure is insufficient, creating unnecessary hurdles to access in both the public and private sectors.
- Supporting policies at the state level such as an expanded deposit return system, extended producer responsibility, and minimum recycled content laws could provide essential supply and demand to Michigan’s circular economy and establish long term funding mechanisms to support equitable diversion programs and infrastructure development.
- Mechanisms for collaboration need continued support and development across communities, across industries, and across the public and private sectors as they jointly invest in Michigan’s circular economy.

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<sup>1</sup> Additional details and citations are presented in the State-Level Policy and Funding Mechanisms section of this report.

<sup>2</sup> Additional details and citations are presented in the Project and Infrastructure Investment section of this report.

This report takes the reader to a much deeper level of understanding current circumstances across much of the material management landscape in the state, identifying where the system is strong and where it is weak. Specific areas of potential investment and solution development are highlighted. The following are some of those key “next level” action areas the reader can look forward to:

- Surveying the commercial sector to obtain more robust recycling data
- A focus on two key diversion materials – food waste and MRF compatible recyclables
- Developing diversion access for multi-family and commercial generators
- Equitable curbside recycling access
- Statewide “super” drop-off access for other recyclables
- Incorporating food waste into organics collection programs
- Infrastructure investments in MRF and organics processing
- Integrating environmental justice considerations into all investments
- End-market investments to support full circularity
- Coupling supply- and demand-side policy to fund diversion efforts and grow the circular economy
- Align Materials Management Planning with investment opportunities to accelerate implementation
- Elevate the role of materials management in Climate Action Planning and connect funding opportunities

This report is organized to enable reader comprehension of these areas, as follows:

- Terminology
- Introduction
- Current Disposal and Recovery Landscape
- Potential Recovery to Reach 45% Diversion
- Diversion Program Access
- Processing Infrastructure
- End Markets
- Economic Contribution and Economic Impact of Reaching 45% Diversion
- Project and Infrastructure Investment
- State-Level Policy and Funding Mechanisms
- Conclusions
- Citations
- Appendix

This report informs and invites the innovation, partnership, and engagement investments required for Michigan to transform its materials management system from a linear “take, make, use, and dispose” model to the circular “take, make, reuse, and recycle” model. If successful, Michigan will realize environmental benefits through substitution of virgin inputs for recycled commodities and reduction of greenhouse gas emissions, while also gaining major economic benefits in the collection, processing, and manufacturing sectors across the state.<sup>3</sup>

For further information, and to find out more about how you and your organization can be part of this transformation, please go to [NextCycleMichigan.com](https://NextCycleMichigan.com) and [EGLE Materials Management in Michigan](#).

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<sup>3</sup> Greenhouse gas emission reductions due to achieving the 45% diversion rate are discussed in the 2021 Gap Analysis Report.

# TERMINOLOGY, DEFINITIONS, AND ACRONYMS

## ACRONYMS

Michigan Department of Environment, Great Lakes, and Energy (EGLE)

## PLASTIC RESIN TYPES

- Polypropylene (PP)
- Polyethylene terephthalate (PET)
- High-density polyethylene (HDPE)
- Polyethylene (PE)

## DEFINITIONS

**Average Commodity Revenue (ACR)** – Average commodity revenue refers to the average price for a ton of recovered commodities at a MRF.

**Benchmark Recycling Standard (BRS)** – The benchmark recycling standard is part of the update to Michigan's Part 115 Solid Waste Management laws in 2022. The BRS sets a minimum access level to residential recycling opportunities (Department of Environment, Great Lakes, and Energy 2022).

**Chemical Conversion Technologies** – Chemical conversion technologies refer to use of heat and/or chemical reactions to break down plastics into their molecular components for reuse as new plastics or fuel. Examples of chemical conversion technologies includes pyrolysis, gasification, and solvolysis.

**Compostable Products** – Utensils, food service containers, and other packaging and products that are certified by the Biodegradable Products Institute, or an equivalent recognized third-party verification body, as meeting either of the following requirements: (a) ASTM D6400, "Standard Specification for Labeling of Plastics Designed to Be Aerobically Composted in Municipal or Industrial Facilities", by ASTM International; or (b) ASTM D6868, "Standard Specification for Labeling of End Items that Incorporate Plastics and Polymers as Coatings or Additives with Paper and Other Substrates Designed to Be Aerobically Composted in Municipal or Industrial Facilities", by ASTM International (Act 451 1994).

**Composting Facility** – A facility where composting occurs (House Bill 4454 2022).

**Council of Governments (COG)** – Multi-county organizations in Michigan that support activities such as grant writing, economic and community development, coordination of services, and any other services beneficial for counties to organize together. A table showing county to COG relationships is presented in the Appendix for Current Disposal and Recovery Landscape.

**Deposit Return System (DRS)** – A deposit return system is a form of EPR where the producer initiates a deposit on a container that is paid by consumers at the point of sale. Once the container is returned, the consumer redeems the paid deposit and the container is entered into the recycling stream.

**End Markets** – End markets in this report is a broad term that also includes processors such as plastic reclaimers, brokers, and manufacturers such as ferrous and non-ferrous foundries, paper and pulp mills, and glass container manufacturers.

**Extended Producer Responsibility (EPR)** – A policy approach that requires producers to take financial and/or physical responsibility for management of the products and/or packaging they produce at the end of their useful life.

**Printed Paper and Packaging (PPP)** – Printed paper and packaging can refer to a variety of different materials including all paper and packaging materials and non-durable paper and plastic items. Often EPR programs are designed to cover printed paper and packaging materials and are referred to as EPR for PPP.

**Foodservice Packaging (FSP)** – Packaging that primarily includes single-use products such as cups (beverage and portion), plates, platters, bowls, trays, beverage carriers, bags (single portion and carry-out), containers, lids and domes, wraps, straws, cutlery and utensils for the service, and/or packaging of prepared foods and beverages in foodservice establishments (Foodservice Packaging Institute 2023).

**Food Waste** – Animal or vegetable matter that was used or intended for human or animal food or that results from the preparation, use, cooking, dealing in, or storing of animal or vegetable matter for human or animal food if the accumulation is or is intended to be discarded. Food waste does not include fats, oils, or greases (Act 451 1994).

**Material Recovery Facility (MRF)** – A facility that meets both of the following requirements: (a) receives primarily source-separated material and sorts, bales, or processes the source-separated material for reuse, recycling, or utilization as a raw material or new product and (b) on an annual basis, does not receive an amount of solid waste equal to or more than 15% of the total weight of material received by the facility unless the MRF is making reasonable effort and has an education program to reduce the amount of solid waste. Material disposed of as a result of recycling market fluctuations is not included in the 15% calculation (Act 451 1994).

**Mechanical Recycling** – Mechanical recycling refers to the process of recovering plastics through sorting, washing, grinding, or pelletizing, and does not change the chemical structure of the material. Mechanical recycling is the historically scaled process for plastics recovery.

**MRF Compatible Recyclables** – Mixed paper, newsprint, corrugated cardboard, plastic bottles, jugs, tubs, glass containers, and aluminum and steel bottles and cans.

**Municipal Solid Waste (MSW)** – MSW refers to household waste, commercial waste, waste generated by other nonindustrial locations, waste with characteristics similar to that generated at a household or commercial business, or any combination thereof. MSW does not include municipal wastewater treatment sludges, industrial process wastes, automobile bodies, combustion ash, or construction and demolition debris (Act 451 1994).

**Other Recyclables** – Plastic film, bulky plastics, scrap metal, rubber, textiles, electronics, and other materials that may be recycled but cannot be sorted at MRFs.

**Organics and Compostables** – Organic material such as food waste, yard clippings, wood waste, and compostable paper that can be converted to finished compost. In the State of Michigan, compostable material comprises class one compostable material and class two compostable material.

**Recycling, Reuse, and Remanufacturing (RRR)** – Refers to the recycling, reuse, and remanufacturing industries in Michigan that form the basis of the recovery economy in the state. RRR industries include recycling and organics collection, material processing such as material recovery and compost facilities, end markets, and supporting services such as administrative work supporting the recovery industry.

**Waste Data System (WDS)** – The waste data system is an EGLE operating database<sup>4</sup> that tracks activities at regulated sites including solid waste and compost facilities ().

## CURBSIDE RECYCLING ACCESS

**Commercial** – The commercial sector refers to MSW and recycling generated and collected from the commercial and institutional sectors, specifically referring to establishments with North American Industry Classification System codes 42 through 92.

**Contracted/Franchise** – A community which has a contract with a franchised hauler. All residents/property owners in the community must contract with the hauler that the community government has chosen for curbside pickup of recyclables.

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<sup>4</sup> <https://www.egle.state.mi.us/wdspi/Home.aspx>

**Multi-family** – In this report, the multi-family sector refers to households within dwellings of five units or more.

**Municipal** – The community self-funds and manages their own hauling system. All residents/property owners in the community must enroll in the municipal curbside recycling program.

**No Curbside Program** – There was no curbside recycling program found for the community. RRS's data is continuously being updated, and the community's service type may change with additional data collection.

**Single-Family** – In this report, the single-family sector refers to households within dwellings of four units or fewer.

**Subscription** – The residents/property owners in the community must self-select a hauler operating in the area. The residents/property owners choose to enroll in a subscription curbside recycling program.

## **DROP-OFF RECYCLING ACCESS**

**County Program** – There are drop-off points within the county that are run and funded by the county, and are only open to county residents, or are primarily visited by county residents.

**Residents Only** – Only residents of one community may utilize the program. The program is located within that community (e.g., township-run programs).

**Service-Area** – The municipal boundaries of where residents may utilize the program can live (e.g., regional programs open to two to four specified townships adjacent to one another).

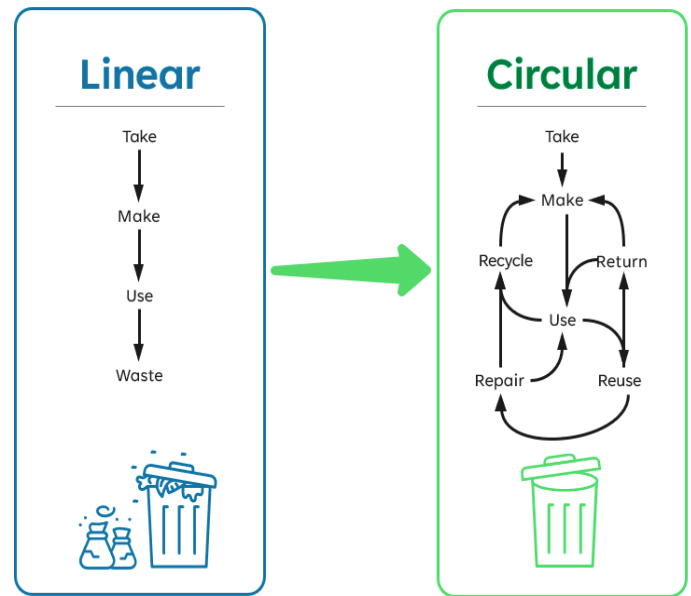
**Specified Residents** – Two or more communities can utilize the program, but it is not a county-wide program.

**25-Minute Drive Time Open to All** – An area generated by a spatial analysis of roads driving to a drop-off point that is "open to all," including any resident of any area. The area modeled is a 25-minute drive time according to the speed limit of the area.



# INTRODUCTION

The following report is an update to the Michigan Gap Analysis report of 2021. The 2023 Gap Analysis update is written against the backdrop of the recently enacted overhaul to Michigan’s solid waste laws that addressed many aspects of solid waste management across Michigan. The legislation’s primary goal is to move the state from disposal management to materials management and planning that emphasizes recovery and diversion initiatives. The new legislation bolsters EGLE’s efforts to increase diversion at all levels in the state and codifies the 45% diversion goal into law. As such, the aim of this report is to assess where Michigan’s recovery programs, infrastructure, and economy are today and what actions the state could take to achieve their target diversion goals, including ensuring equitable diversion program access, effective infrastructure investment, and policy and funding approaches that would strengthen the state’s materials management system. By moving away from the linear “take, make, use, and dispose” model to the circular “take, make, reuse, and recycle” model, Michigan will realize environmental benefits through substitution of virgin inputs for recycled commodity and reduction of greenhouse gas emissions while also gaining major economic benefits in the collection, processing, and manufacturing sectors across the state.<sup>5</sup>



Michigan has made significant progress in supporting the diversion industry across the state with over \$771 million tracked for investments across the state which support growth of the circular economy, and over \$29 million of investment from grant funding through EGLE Recycling Market Development and Recycling Infrastructure Grants since establishment of the Renew Fund. While the progress is notable, there is still considerable work to accomplish.

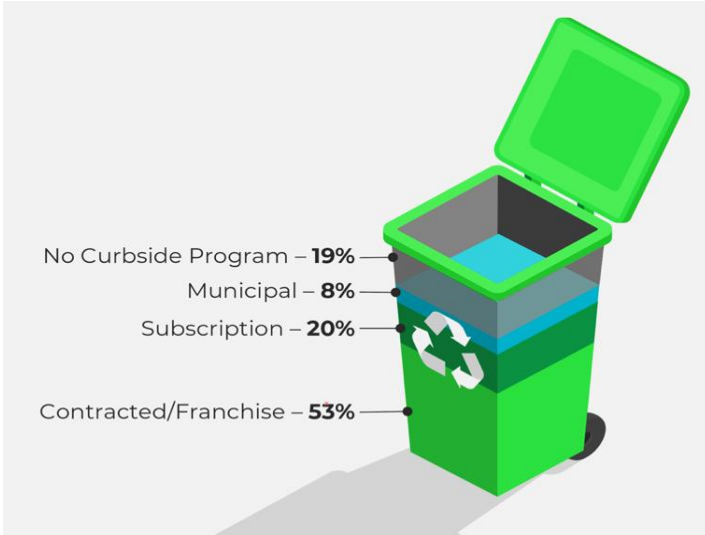
Despite efforts to increase diversion, Michigan disposed of 8.2 million tons of MSW in 2022. Data tracking of diversion is challenging in any state, and Michigan is no exception. While MRFs and other entities are reporting annually to EGLE under Part 175, it is likely the state is missing large portions of diverted tonnage that moves via business-to-business channels in the commercial sector and scrap metal recycling that never gets reported. The total missed tonnage may amount to more than 900,000 additional tons being diverted annually in the state.

Reaching the 45% diversion goal will require diversion program expansion and investment in education and outreach in all MSW-generating sectors including single-family and multi-family households and the commercial sector. This report shows the breakdown of the additional recovery needed from each generating sector and material type, amounting to a total 2.67 million tons of MRF compatible recyclables, other recyclables, and organics and compostables.

Figure 1 shows curbside service type by percent of total population in the state. The majority of curbside service, representing access for 53% of the population, is provided via contracted or franchised agreements between a municipality, township, or authority and a private hauler. Approximately 20% of Michigan’s population receives recycling services through subscription programs, and 8% receive curbside recycling services provided directly by their municipality. Approximately 19% of Michigan’s total population, including single-family and multi-family residents, do not have access to curbside recycling. Currently, 93% of single-family households in communities with a population of 5,000 or greater have access to curbside recycling either supplied by the municipality through municipal collections or contracting, or through subscription sign-up programs. However, gaps remain in recycling program access in the state.

<sup>5</sup> Greenhouse gas emission reductions due to achieving the 45% diversion rate are discussed in the 2021 Gap Analysis Report.

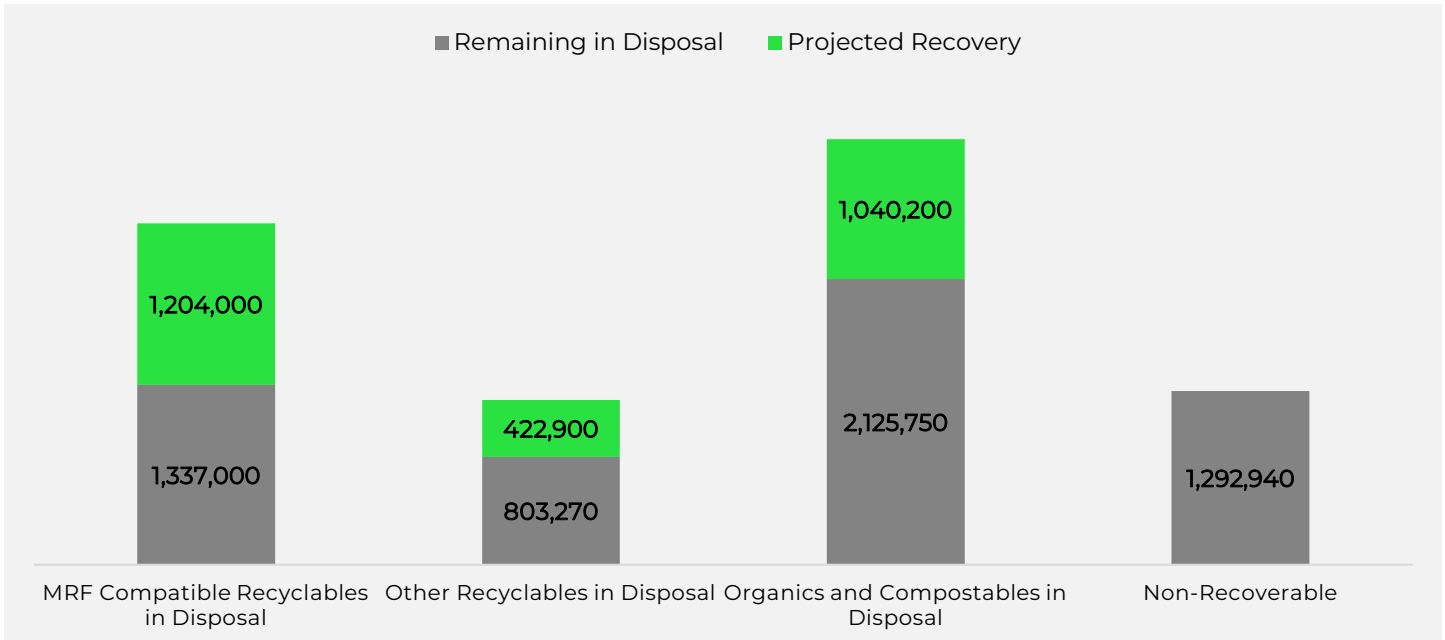
Figure 1: Curbside Service Type Available by Percent of Total Population



While residents may have access to curbside programs, they also need to participate in the programs and know how to separate their recyclables from trash appropriately. Additionally, Multi-family and commercial access are lagging with most communities not addressing access for those sectors, leaving the offering of recycling services entirely up to the private sector and desire of the property management company or business. Additionally, for every one curbside recycling program in place in the lowest household income communities in Michigan, there are three curbside recycling programs in the highest household income communities in Michigan. Equitable curbside recycling access is essential to reaching the 45% diversion goal. EGLE has made progress extending program assistance and grant funding to lower income communities lacking curbside programs, and these efforts need to be continued to increase recycling access and reduce disparities in recycling access across the state.

After collection, materials management processing infrastructure such as MRFs and compost facilities are essential for the circular economy. In 2022, Michigan processed more than 411,400 tons of recyclables, and composted more than 309,300 tons of organics waste, predominantly yard waste. While the reported composting tonnage in 2022 was lower than 2021, the significant amount of Michigan’s yard waste that is diverted from landfill continues to demonstrate the success of Michigan’s yard waste landfill ban. Figure 2 shows the total additional tons of MSW that needs to be recovered to reach the 45% diversion goal. Additional MRF and organics processing capacity is needed to process the 1.2 million more tons of MRF compatible recyclables and 1.0 million tons of organic waste (46% of which is food waste) that need to be collected to reach 45% diversion. It is critical moving forward that infrastructure development is conducted in a thoughtful manner, taking environmental justice factors into consideration and reducing burden on communities with high environmental risk factors. If all new infrastructure were built to handle the additional 1.2 million tons of MRF compatible recyclables and 1.0 million tons of additional organics and compostables, capital infrastructure investments would likely need to range from \$301 to \$357 million for MRFs and \$165 to \$225 million for compost facilities.

Figure 2: Total Tons of MSW that Needs to be Recovered to Reach 45% Diversion (Green) Compared to Material Remaining in Disposal (Grey)



End markets for recovered material provide essential jobs and economic output for the state of Michigan. In the past two years, significant changes have occurred both in Michigan and regionally for plastic film and PP end markets, including new or expanding end markets for chemical conversion technologies and mechanical recycling both in the regional area and state. In particular, the Great Lakes region has become a hub for investment in chemical conversion technologies that have the potential to greatly change the plastics recovery landscape.

Collection, processing, and end markets along with reuse and remanufacturing encompass the RRR industries that contribute 72,500 total direct, indirect, and induced jobs in Michigan as well as \$17.1 billion in total economic output. Reaching the 45% diversion rate would potentially add 47,800 jobs and \$11.6 billion additional economic output for Michigan.

Implementation of state-level policy has the potential to change the supply and demand dynamic of the materials management system in the state. For example, EPR for PPP policies are considered a supply-side policy that can provide a major, consistent funding source for collection programs, both curbside and drop-off. The funding generating from EPR for PPP stabilizes the RRR industry of state, incentivizing long-term investments by key players, such as processors and end markets that can now depend on a constant stream of material. EPR for PPP also provides funding to help drive equitable access in diversion programs. Demand-side policy, such as minimum recycled content requirements, complement EPR for PPP programs by creating a steady demand by end markets for collected material. Other policy options to drive diversion that are discussed in this report include deposit return systems, single-use items taxes and fees, and organics diversion policies.

## TAKEAWAY ACTION ITEMS

Below are some key action items for EGLE to take based on the findings of this report.

### DATA TRACKING

- **Improved data tracking to capture commercial sector** – Michigan currently has little data on commercial business-to-business flow of material from retailers and scrap yards resulting in possible hundreds of thousands of missed tons in recycling that is not counted towards the state's recycling goals. Michigan could consider surveying the commercial sector annually as is done in Ohio and Pennsylvania.

### DIVERTABLE MATERIAL FOCUS

- **Food waste diversion programs and processing** – Food waste encompasses 18% of the total needed additional diversion for Michigan to reach 45%, and currently there are few food waste collection programs available to residents and organics facilities accepting food waste for processing.
- **Capture of more MRF compatible recyclables** – MRF compatible recyclables are materials in the disposal stream that could readily be recovered and processed through MRFs and sent to established end markets. Michigan needs to capture an additional 1.2 million tons of MRF compatible recyclables to reach the 45% diversion goals. Much of the work to successfully capture these materials will lie in growing recycling program access and ensuring processing capacity across the state.

### DIVERSION PROGRAM ACCESS

- **Expanding curbside access** – Approximately 19% of Michigan residents live in communities without curbside recycling programs, including both residents living in single- and multi-family households.
- **Ensuring multi-family and commercial recycling** – At present, multi-family and commercial recycling access is nearly entirely up to the private sector and the will of businesses and property managers. Many multi-family residents lack on-site recycling access, and 22% of Michigan's multi-family population lives in communities without any drop-off recycling program.
- **Equitable curbside recycling access** – The highest income households in Michigan are nearly three times more likely to have access to a curbside recycling program compared to the lowest income households. EGLE has set forth a goal to make recycling access as easy as disposal, and this will require investment in lower income communities that may need financial assistance to gain access. To make curbside recycling programs as convenient as trash, the state cannot simply rely on the ability of residents to pay for extra services.

- **Statewide “super” drop-off access for other recyclables** – As mentioned above, drop-off recycling sites provided necessary recycling access for multi-family residents and are also critical even in areas with universal curbside recycling programs because not all recyclable material can be collected at the curb. To reach the 45% diversion goal, Michigan needs to capture 422,900 tons of other recyclables out of the disposal stream for diversion, and those material will need to be collected at drop-off recycling sites across the state.
- **Incorporating food waste into organics collection programs** – Few Michigan residents have access to curbside or drop-off food waste recycling programs yet diverting food waste from its landfills is a pressing issue in the fight against climate change and will have a huge impact on the state’s ability to reach their recycling goals. Many Michigan residents already have access to some level of curbside organics collection due to the state’s landfill ban and these programs are a potential opportunity to gain access to food waste recovery with co-collection of food and yard waste.

## CIRCULAR ECONOMY INFRASTRUCTURE

- **MRF and organics processing infrastructure** – Michigan needs to process three times as much volume of MRF compatible recyclables than what is currently doing through MRFs to reach the 45% diversion rate. Doing that will likely require significant investment in new MRFs across the state as well as additional equipment investments at existing MRFs. Michigan currently has 184 compost sites across the state; however, the vast majority of these sites are low-tech windrow operations designed primarily to process fall leaves and yard waste. The state will need to invest in composting and anaerobic digestion facilities capable of accepting large quantities of food waste with yard waste.
- **Environmental justice considerations** – EGLE has begun to address the impact of environmental justice on communities, including measuring the impact of solid waste facilities on a community’s environmental health score<sup>6</sup>. When investing in processing infrastructure across the state, it is crucial that EGLE continues to consider environmental justice concerns when siting new facilities.
- **End market investments to support full circularity** – The circular economy cannot fully function without end market demand for recycled commodity. Michigan has strong end markets in plastics, paper, and metals and there has been significant regional investment in chemical conversion technologies that could significantly impact the recoverability of plastics, particularly film. Continued conversations with existing end markets and investments to attract additional end market demand in the state is an important focus to ensuring continued end market demand for recycled commodities.

## STATE-LEVEL POLICY AND FUNDING MECHANISMS

- **Coupling of supply and demand side policy to fund diversion efforts and support circular economy** – Supply-side policy such as Michigan’s DRS and EPR for PPP can provide significant financial support for collection programs and education and outreach to increase participation and reduce contamination. Coupled with supply-side policies are demand-side policies, such as minimum recycled content requirements, which spur demand for recycled commodity by end markets. Together supply and demand policies are complimentary and could significantly grow recovery rates to levels that have yet to be achieved in the U.S.
- **Funding for materials management planning** – EGLE’s annual Recycling Grants are supported by the Renew Michigan Fund. Various annual grants are made available to local government, tribal organizations, non-profit, and for-profit entities to support Michigan’s materials management system to grow recycling in the state.
- **Elevate the role of materials management in climate action planning and connect funding opportunities** – The MI Healthy Climate Plan lays out a pathway for Michigan to reach 100% carbon neutrality by 2050. Investments in material diversion, recycling, and end market infrastructure support climate action planning by creating a circular economy and sustainable Michigan.

<sup>6</sup> <https://www.michigan.gov/egle/maps-data/miejscreen>

# CURRENT DISPOSAL AND RECOVERY LANDSCAPE

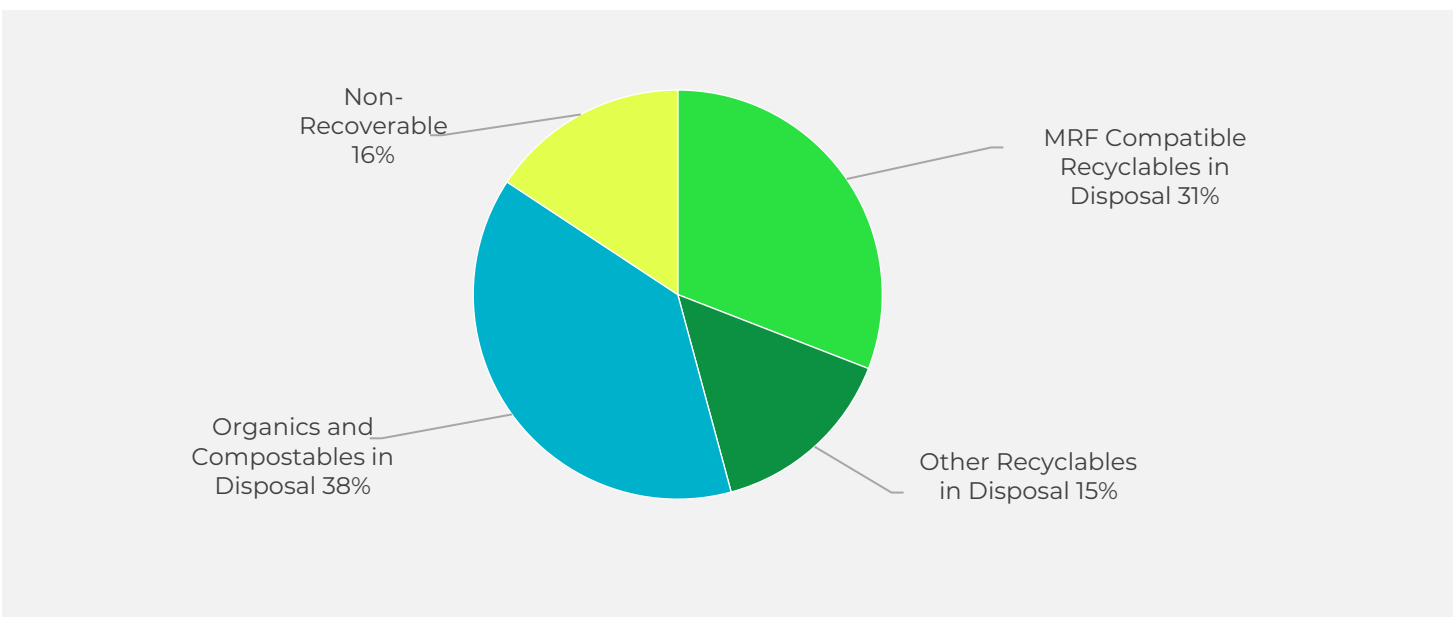
## CURRENT MSW DISPOSAL

Michigan disposed of 8,226,060 tons of MSW in 2022 (Department of Environment Great Lakes and Energy 2023g).<sup>7</sup> Of that disposed waste, approximately 84% is recoverable in today's recovery economy. Table 1 and Figure 3 show the breakdown of Michigan's MSW disposal stream by type, categorizing materials into four general categories: MRF compatible materials, organics and compostables, other recyclables, and non-recoverable materials. MRF compatible materials such as mixed paper, cardboard, plastic bottles, tubs, jugs, aluminum and steel cans, and glass containers account for 2.5 million tons (31%) of the MSW disposal stream and could be captured via curbside or drop-off programs and diverted through MRFs for processing. Other recyclables such as plastic film, bulky plastics, scrap metal, textiles, and electronics account for 1.2 million tons (15%) of MSW disposal and could be captured through drop-off programs and sold to various end markets. Organics and compostables, such as yard, food, and wood waste, as well as compostable paper account for 3.2 million tons (38%) of the MSW disposal stream and could be captured via curbside or drop-off programs and processed through composting or anaerobic digestion. The remaining 1.3 million tons (16%) of material in Michigan's MSW stream is not currently recoverable in today's economy. Table 2 presents the total disposal of the residential and commercial streams in tons by COG and categorized by potential recovery stream type.<sup>8</sup>

Table 1: Total Tons MSW Disposed in Michigan Broken Down by Stream Type<sup>8</sup>

STREAM TYPE	TOTAL
MRF Compatible Recyclables	2,541,000
Other Recyclables	1,226,170
Organics and Compostables	3,165,950
Non-Recoverable	1,292,940
<b>Total</b>	<b>8,226,060</b>

Figure 3: Total Proportion of MSW Disposed in Michigan Broken Down by Stream Type



<sup>7</sup> RRS calculated the total tons of MSW disposed of in the state of Michigan from the EGLE Report of Solid Waste Landfilled in Michigan October 1, 2021 – September 30, 2022, utilizing the cubic yard to tons conversion factor of 3.3 tons per cubic yard.

<sup>8</sup> A table showing each county's COG is presented in Appendix For Current Disposal and Recovery Landscape.

Table 2: Total Disposal by COG Categorized by Potential Recovery Stream Type (Tons)

COG	MRF COMPATIBLE RECYCLABLES	OTHER RECYCLABLES	ORGANICS AND COMPOSTABLES	NON-RECOVERABLE	TOTAL
1	1,202,610	581,060	1,500,540	613,040	3,897,250
2	76,280	36,840	95,130	38,850	247,100
3	142,940	68,950	178,030	72,690	462,610
4	70,600	34,080	88,000	35,940	228,620
5	137,450	66,540	171,900	70,260	446,150
6	120,250	58,000	149,730	61,140	389,120
7	206,050	98,590	254,190	103,550	662,380
8	317,650	153,480	396,390	161,940	1,029,460
9	33,350	16,090	41,560	16,980	107,980
10	77,290	37,340	96,440	39,400	250,470
11	13,530	6,510	16,810	6,870	43,720
12	49,950	23,750	61,160	24,860	159,720
13	19,820	9,570	24,710	10,090	64,190
14	73,230	35,370	91,360	37,330	237,290
<b>Total</b>	<b>2,541,000</b>	<b>1,226,170</b>	<b>3,165,950</b>	<b>1,292,940</b>	<b>8,226,060</b>

## CURRENT RECOVERY

The current recovery rate in Michigan is challenging to measure due to gaps in data reporting. EGLE receives recycling data from several sources, including MRFs under the Part 175 Recycling Reporting of Act 451; however, this data is not a comprehensive picture of all recycling occurring in the state. For example, the reported data is likely missing some or all diversion occurring within Michigan’s DRS, textile recovery markets, commercial “Big Box” store recycling, and scrap metal. The following sections detail reported Part 175 recycling data as well as estimated recycled tons in the state that are currently not being captured under Part 175. These data could be considered additional to the Part 175 data and EGLE’s estimation, however, detailed information regarding reporting entity combined with reported materials are not available outside EGLE, so RRS cannot fully determine the level of additional recycled tons. EGLE could utilize the data provided below to inform their estimated recycling rate moving forward.

## PART 175 REPORTED DATA

The 2022 reported recycling data is presented in Table 3. The reported data is posted online annually by EGLE and to the state legislature. A challenge with the reported recycling data in Michigan is that not all recycling activity within the state is required to be reported under Part 175, and, as such, the reported data is considered a likely minimum recycling rate for the state of Michigan, with true recycling rates likely being significantly higher. In 2022, EGLE estimated the recycling rate in Michigan at 21% using several data sources (Department of Environment, Great Lakes, and Energy 2023a).

Table 3: Part 175 2022 Reported Recycling (Tons)

PRIMARY MATERIAL TYPE	TOTAL TONS
Construction & Demolition	100
Electronics	255
Ferrous Metal, Including White Goods	109,629
Glass	71,557
Household Bulky Waste	24
Household Hazardous Waste	277
Nonferrous Metals	44,534
Organics	453
Paper And Paper Products	339,473
Plastic And Plastic Products	45,327
Residuals	194,591
Single stream Recyclables	6,648
Textiles	3,327
Tires	270
<b>Total</b>	<b>816,464</b>

In addition to the Part 175 reported data, EGLE also receives reported data from registered compost facilities across the state. In 2021 a total of 309,322 tons of total organic waste was reported as recovered at Michigan compost facilities<sup>9</sup>. A detailed discussion on organics facility processing is presented in the Processing Infrastructure section of this report. RRS cannot determine from the data made available by EGLE if the 453 tons of organics reported under Part 175 are also included in the reporting by compost facilities.

### MICHIGAN DEPOSIT RETURN SYSTEM

Michigan’s DRS, also known as the bottle bill, was enacted in 1976 and currently includes soft drinks, soda water, carbonated natural or mineral water, other nonalcoholic carbonated drinks, beer, ale, malt drinks, and mixed wine and spirit drinks. Michigan’s deposit is set at 10 cents per redeemed deposit container. Redemptions are reported as total number of containers and can be converted to tons with estimates of proportion of stream type, glass, PET, and aluminum, and average container weights.<sup>10,11</sup> Table 4 presents the estimated total tons recycled through Michigan’s bottle bill.

Table 4: Estimated Deposit Container Recycling 2022 (Tons)

Material	Container Weights (lbs. per Container) <sup>10</sup>	% of Stream <sup>11</sup>	# of Containers	Weight (lbs.)	Weight (Tons)
Glass	0.4926	15.0%	452,700,000	223,004,926	111,502
PET	0.0420	20.0%	603,600,000	25,361,345	12,681
Aluminum	0.0332	65.0%	1,961,700,000	65,172,757	32,586
<b>Total</b>			<b>3,018,000,000</b>	<b>313,539,028</b>	<b>156,770</b>

<sup>9</sup> Note that RRS used the latest available data. In the case of Part 175 this was 2022 data. However, at the time this report was written only 2021 organics facility data were available.

<sup>10</sup> Average container weights sourced from CalRecycle Biannual Report of Beverage Container Sales, Returns, Redemptions, and Recycling Rates (CalRecycle 2022).

<sup>11</sup> The proportion of the stream type was estimated from Container Recycling Institute data (Container Recycling Institute 2015).

## MICHIGAN COMMERCIAL “BIG BOX” RETAIL RECYCLING ESTIMATE

### “BIG BOX” RETAIL MODELING METHODOLOGY AND RESULTS

Available data on source-separated commercial recycling that moves directly from the generator to end markets are limited. Many states do not collect data on business-to-business recycling activity; however, some data is available. Both Ohio and Pennsylvania survey commercial entities operating within their state to collect recycling data. Retailers operating multiple stores across the state, such as the “Big Box” retail stores, are surveyed by the Ohio Environmental Protection Agency (OEPA) in Ohio and the Professional Recyclers of Pennsylvania (PROP) in Pennsylvania. Smaller commercial entities not operating multiple locations are surveyed in both states by the solid waste district managers in Ohio and county recycling coordinators in Pennsylvania. For both states, collecting commercial recycling data is critical for ensuring compliance with recycling laws and obtaining grant funding for recycling programs.

The OEPA publishes the results from the survey of “Big Box” stores as well as MRFs annually in their Ohio Material Recovery Facilities and Commercial Recycling report (Ohio Environmental Protection Agency 2023). The report details individual retailers and MRFs by name and the materials and tons collected for recycling.

The Pennsylvania Department of Environmental Protection (DEP) publishes total annual tons for recycled commodity, separating residential and commercial recycling (Pennsylvania Department of Environmental Protection 2023).

Given that Ohio’s data was most readily available to identify “Big Box” retailer recycling, RRS utilized Ohio’s commercial reports from 2019, 2020, and 2021 to estimate Michigan’s annual “Big Box” retailers total recycling<sup>12</sup>. Ohio’s data, gathered from surveys from large retailers, is an effort to measure collection of source-separated materials such as cardboard, plastic film, and wood pallets that bypass MRFs (Appendix Table 52). It is possible that recycling collected from the “Big Box” retailers in Michigan are reported to EGLE by MRFs that primarily focus on commercial streams or registered recyclers that process source-separated materials from commercial entities, however, RRS cannot determine this definitively without access to the detailed data. EGLE may want to compare the potential estimated recycling from “Big Box” stores presented in this report with reported data from potential commercial recycling processors in Michigan.

RRS determined a material per store recycling metric for each non-MRF reporting entity in Ohio’s Material Recovery Facilities and Commercial Recycling report. RRS also determined the number of individual stores each reporting retailer has in both Ohio and Michigan (Appendix Table 53). The calculated per store recycling metric was applied to the corresponding Michigan retailers to model the potential recycling of “Big Box” retailers in the state. This methodology assumes that the large retailers operating across multiple states have similar stores size and employee counts and have standard operating procedures rendering recycling rates similar from Ohio to Michigan. For example, the per store recycling rate for Meijer in Ohio would be similar to the per store recycling rate for Meijer in Michigan. One caveat to this assumption is that Michigan is a bottle deposit state while Ohio is not. However, the data reported by “Big Box” retailers to the Ohio EPA show that items such as glass, which in the case of glass bottles is covered under the deposit system in Michigan, are extremely low, indicating the bottle redemptions are not a major component of recycled material for the retailers.

Table 5 shows the modeled recycling rate for large commercial retailers in Michigan as well as the United States Postal Service (USPS), and Figure 4 shows the proportion by commodity of estimated recycling. Cardboard makes up the vast majority of estimated recycling at 80% or 256,690 tons. The second largest recovered material category is wood (pallets) accounting for 10.3% of total recovery or 33,090 tons. Plastic and mixed paper make up 2.8% (9,100 tons) and 2.9% (9,420 tons) respectively. Together these four categories – cardboard, wood, plastic, and mixed paper – account for 96% of the modeled recovered materials from Michigan’s “Big Box” retailers and the USPS. The retailers listed in Table 5 represent roughly 9% of total retail establishments in Michigan, however, are estimated to represent nearly a quarter of total retail employment in the state.<sup>13</sup>

<sup>12</sup> The “Big Box” retailer recycling data from OEPA would include materials backhauled to distribution centers. RRS is assuming the ratio of distribution centers to stores in Ohio and Michigan for the large retailers is similar.

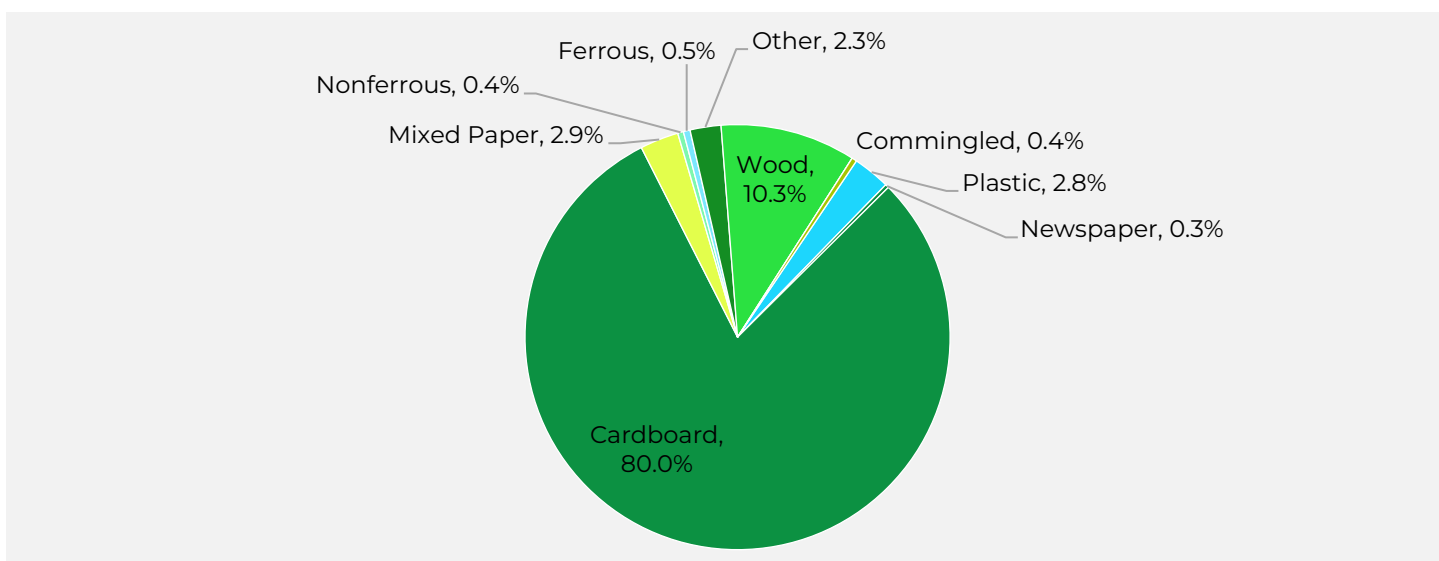
<sup>13</sup> Retail employment refers to business with NAICS codes 44 through 45. Total estimates of retail establishments and employment in Michigan is from the U.S. Economic Census 2021 Economic Survey. Employment for retailers was estimated using a variety of sources including the Dun & Bradstreet database and U.S. Bureau of Labor Statistics.



Table 5: Michigan Modeled “Big Box” Retailer and USPS Recycling Estimates (Annual Tons)

COMMERCIAL RETAILER	PLASTIC	NEWSPAPER	CARDBOARD	MIXED PAPER	NONFERROUS	FERROUS	OTHER	WOOD	COMMINGLED <sup>14</sup>	TOTAL
ALDI Inc.	230	0	10,360	0	0	0	0	9,260	0	19,840
CVS	0	0	1,050	0	0	0	0	0	600	1,640
Dollar General	170	0	19,310	80	0	0	0	0	0	19,550
Home Depot	20	0	4,430	0	0	0	860	11,080	0	16,390
Kohls	130	0	3,360	0	10	0	70	0	0	3,560
Kroger	1,540	380	45,660	0	0	0	730	0	0	48,310
Lowe's	20	0	2,930	0	170	0	940	2,950	0	7,040
Meijer	5,050	0	84,650	230	0	1,640	10	0	0	91,570
REI	0	0	0	0	0	0	0	0	280	290
Sam's Club	250	0	10,460	30	0	0	730	2,760	0	14,220
Save-A-Lot	20	0	1,070	0	0	0	0	0	0	1,090
Target	370	0	14,170	0	270	0	0	0	160	14,980
United States Postal Service	160	0	480	9,000	0	0	0	0	0	9,650
Walgreens	0	0	340	0	0	0	0	0	170	510
Walmart	1,140	520	58,420	80	960	0	4,220	7,040	0	72,360
<b>TOTAL</b>	<b>9,100</b>	<b>900</b>	<b>256,690</b>	<b>9,420</b>	<b>1,410</b>	<b>1,640</b>	<b>7,560</b>	<b>33,090</b>	<b>1,210</b>	<b>321,000</b>

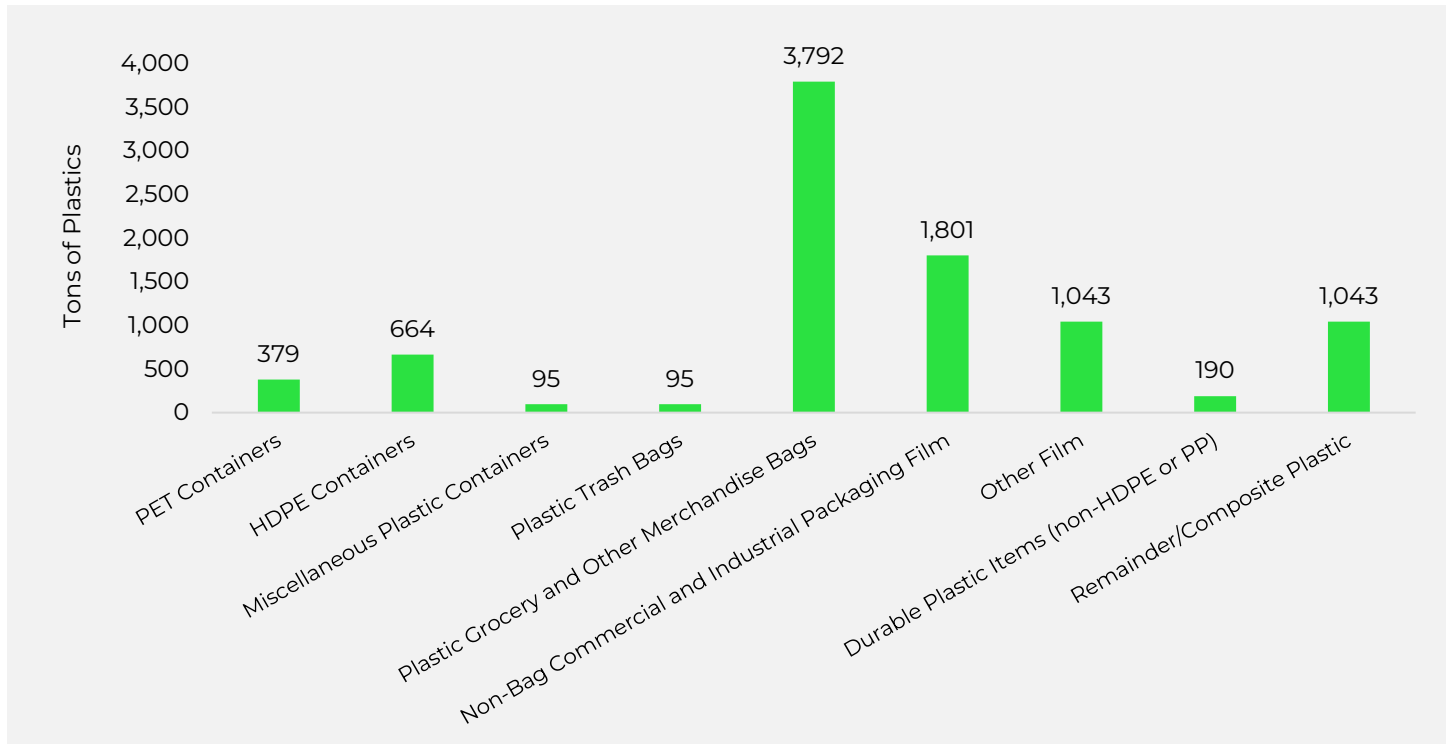
Figure 4: Proportion by Commodity of Modeled Recycling in Michigan for “Big Box” Retailers and USPS



<sup>14</sup> Commingled recycling from “Big Box” retailers is likely represented in Part175 data as commingled recyclables would be processed by MRFs before heading to end markets.

The OEPA data on retail recycling does not break down plastic by resin type, however, CalRecycle commissioned a study that isolated recycling from the retail sector (CalRecycle 2015). RRS utilized the results of the recycled plastic composition from California retailers to breakout the plastics composition from the modeled Michigan plastic recycling (Figure 5). Approximately 74% of the recycled plastics, 6,635 tons, is plastic film. The largest film component is plastic grocery and merchandise bags at 3,792 tons, followed by non-bag commercial and industrial packaging film at 1,801 tons and other film at 1,043 tons. Finally, a small portion of film is recycled trash bags at 95 tons. Beyond film, the next largest component of the plastic stream is remainder/composite plastic, which is mainly plastics combined with other materials and is estimated to comprise 1,043 tons of the plastic recycling from the retail sector. A limitation with using California retail recycling composition data as a model for Michigan retail recycling is that recycling laws differ significantly between the two states. Moving forward, targeted commercial recycling composition studies in Michigan would aid greatly in understanding what materials are actually being recovered.

Figure 5: Estimated Recycled Plastic Composition from Michigan "Big Box" Retailers (Annual Tons)



## MICHIGAN SCRAP METAL RECYCLING ESTIMATE

### SCRAP METAL MODELING METHODOLOGY AND RESULTS

Detailed data on scrap metal recycling from the residential and commercial sectors is not tracked in Michigan. To understand the spectrum of scrap metal recycling that may be occurring in Michigan, RRS utilized recycling data from Pennsylvania, where commodity-specific scrap metal recycling data is reported (Appendix Table 54). The per person and per commercial employee recycling rate for each scrap metal commodity was calculated for the residential and commercial sectors respectively from the Pennsylvania data. The per capita and per employee rates were then applied to the total population and commercial employment of Michigan to model potential residential and commercial scrap metal recycling (Appendix Table 55).<sup>15</sup>

Table 6 shows the modeled scrap metal recycling in Michigan broken out by commodity type, and Figures 6 and 7 provide a breakdown of estimated scrap metal recycling by residential and commercial sectors and commodity type respectively.

<sup>15</sup> Population data sourced from the 2020 Decennial U.S. Census. Employment data sourced from U.S. Census County Business Patterns 2021 and represents total employment for all established with NAICS codes 42 through 99 (excludes manufacturing, industrial, and agricultural entities).

The vast majority, 89% (or 640,780 tons) of scrap metal recycling is estimated as commercially sourced material, although this is likely to contain scrap metal from residential homes recycled by contractors and service providers. Only 76,500 tons of scrap metal comes directly from residential collections.

More than half of modeled scrap metal recycling is ferrous metals: 58%, or 419,240 tons (46,160 residential tons and 373,080 commercial tons). For the commercial sector, the next largest categories of scrap metal are stainless steel, 17% (109,240 tons) and mixed metals, 16% (99,620 tons). The second and third largest categories for the residential sector are mixed metals, 16% (12,370 tons), and white goods, 8.8% (6,710 tons).

Table 6: Modeled Scrap Metal Recycling in Michigan (Annual Tons)

	ALUMINUM SCRAP	FERROUS METAL	NON-FERROUS METAL	COPPER	BRASS	LEAD	STAINLESS STEEL	NICKEL	WIRE/CABLE	MIXED METALS (INCLUDES DRUM STEEL)	WHITE GOODS	TOTAL
Residential	2,540	46,160	4,420	560	150	2,820	640	0	130	12,370	6,710	<b>76,500</b>
Commercial	14,730	373,080	10,270	2,160	930	3,610	109,240	30	13,960	99,620	13,150	<b>640,780</b>
TOTAL	<b>17,270</b>	<b>419,240</b>	<b>14,690</b>	<b>2,720</b>	<b>1,080</b>	<b>6,430</b>	<b>109,880</b>	<b>30</b>	<b>14,090</b>	<b>111,990</b>	<b>19,860</b>	<b>717,280</b>

Figure 6: Proportion of Scrap Metal Recycling Broken Out by Residential and Commercial

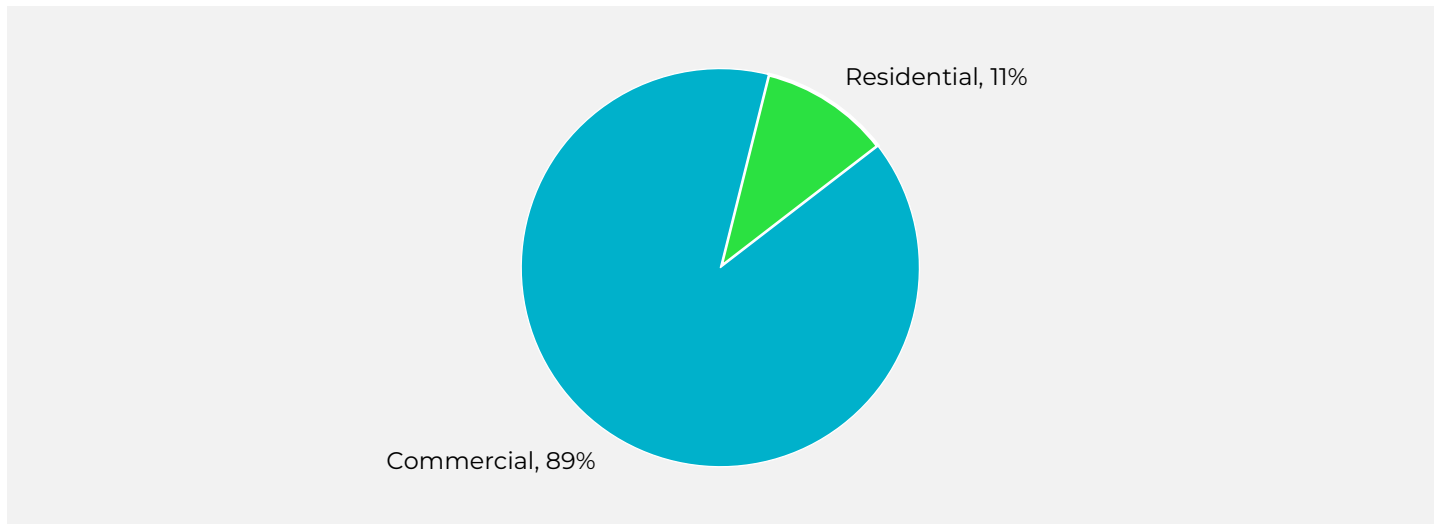
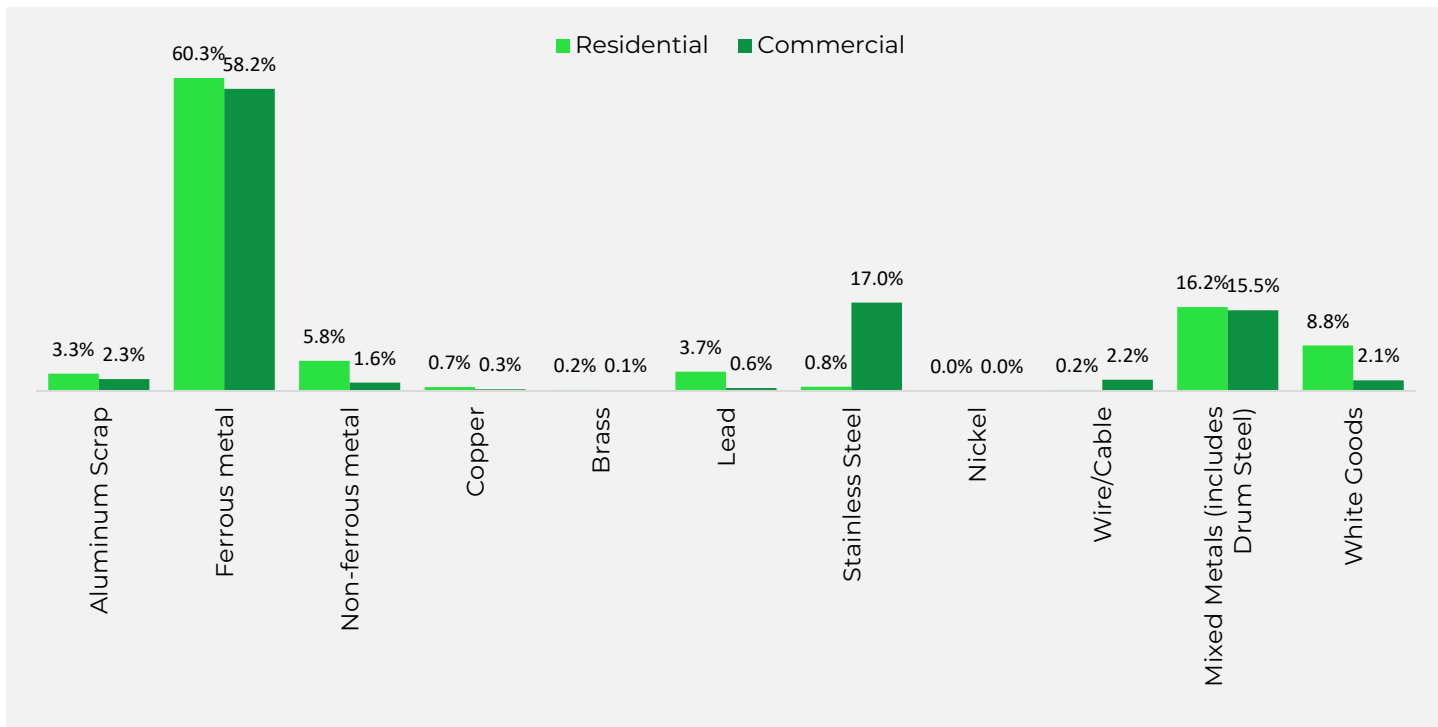


Figure 7: Proportion of Scrap Metal Recycling by Commodity Type for Residential and Commercial Sources



## SECTION SUMMARY

### PART 175 REPORTED DATA

- Annual recycling data is reported to EGLE from recycling entities including MRFs, drop-offs, compost facilities, and brokers. In 2022, 816,464 tons of recycled material was reported under Part 175. While extremely valuable data, reporting limitations within Part 175 means that there is a potential that large portions of the recycling activity in the state are not being captured and recorded under the law.

### MICHIGAN DEPOSIT RETURN SYSTEM

- Estimated deposit returns from Michigan’s bottle bill was 156,770 tons in 2022. These tons are likely missed in Part 175 reported data.

### “BIG BOX” RETAIL RECYCLING TAKEAWAYS

- Part 175 data may be missing more than 300,000 tons of recycled materials from “Big Box” retailers such as Walmart, Target, and Meijer that are collected source-separated and sent straight to end markets based on recycling modeling using data reported from Ohio. It is possible that some of these tons are captured in Part 175 data, and EGLE may be able to examine data reported by entities processing material from the commercial sector to determine if any “Big Box” retailer recycling collected source-separated is currently reported in the state.

### SCRAP METAL RECYCLING TAKEAWAYS

RRS modeled potential ferrous and nonferrous scrap metal recovery in Michigan at 717,280 tons annually, based on per capita and per commercial employment recovery rates from Pennsylvania. Part 175 reported data includes a total of 154,163 tons of ferrous and non-ferrous metal recovered for recycling, significantly lower than the estimated scrap metal recycling in Michigan.

# POTENTIAL RECOVERY TO REACH 45% DIVERSION

The 2021 House Bill 4455, now enacted into law, establishes a goal of reaching a 45% diversion rate in the state of Michigan (House Bill 4455 2022). Getting to this diversion rate will require capturing divertible material from the single-family, multi-family, and commercial MSW streams across the state, and the additional diversion must include MRF compatible recyclables, organics, and other recyclables. RRS modeled achievable potential diversion rates for each generating stream. The 2023 modeling includes a breakout of the multi-family sector, and the detailed methodology of how the multi-family sector was estimated is presented in Appendix for Potential Recovery. In the model, higher diversion goals were placed on MRF compatible recyclables as these are materials that have traditionally been collected in Michigan via curbside or drop-off programs and have developed end markets. Lower diversion goals were placed on materials that must be collected via drop-off such as plastic film or materials that would be considered a newer diversion stream for most communities, such as food waste, since communities would need to build education and outreach programs and infrastructure to capture these materials.

## ADDITIONAL MRF COMPATIBLE RECYCLABLES OUT OF DISPOSAL

An additional 1.2 million tons of MRF compatible recyclables from the single-family, multi-family, and commercial sectors will need to be collected from the disposal stream as part of reaching the state’s 45% diversion goal (Table 7). Capturing 1.2 million tons of MRF compatible recyclables either curbside or drop-off from disposal represents 47% of the MRF compatible recyclables currently in Michigan’s MSW disposal stream. Approximately 8% of the additional MRF compatible recycling would likely need to come from multi-family households through onsite collection or drop-off programs available to multi-family residents. At present, the model does not vary material capture rates by sector, such as single-family and multi-family, to show the full lift required to bring multi-family recycling rates on par with single-family recycling rates. In reality, capturing material from multi-family residents has proven challenging. It should also be noted that to reach the 45% diversion goal without meaningful action on multi-family recycling programs would require capturing even more recycling from single-family residents and commercial businesses and institutions.

Table 7: Additional MRF Recyclables Collection for MRF Processing (Tons)<sup>16</sup>

COG	RESIDENTIAL SINGLE-FAMILY	RESIDENTIAL MULTI-FAMILY	COMMERCIAL & INSTITUTIONAL	TOTAL
1	195,200	46,500	328,600	570,300
2	12,700	2,500	20,900	36,100
3	22,100	6,200	39,500	67,800
4	11,700	2,300	19,400	33,400
5	23,400	4,800	37,000	65,200
6	17,900	5,800	33,300	57,000
7	30,900	6,400	60,200	97,500
8	51,000	12,800	86,700	150,500
9	5,800	800	9,100	15,700
10	12,900	2,600	21,100	36,600
11	2,200	400	3,800	6,400
12	7,100	1,300	15,200	23,600
13	3,300	600	5,400	9,300
14	11,700	2,900	20,000	34,600
<b>Total</b>	<b>407,900</b>	<b>95,900</b>	<b>700,200</b>	<b>1,204,000</b>

<sup>16</sup> Additional recycling tonnage is based off a percent of disposal tonnage, and the numbers shift depending on how much is disposed of in Michigan. In this report, the recycling tonnage is slightly different than the 2021 gap analysis tonnage because the updated model we are using for the 2023 gap analysis is based off FY 2022 disposal tonnages, as opposed to FY 2019 tonnages used in the 2021 analysis.

## ADDITIONAL OTHER RECYCLING AT DROPOFFS OUT OF DISPOSAL

An additional 422,900 tons of other recyclables will need to be collected predominantly via drop-off recycling programs from the single-family, multi-family, and commercial and institutional sectors as part of reaching the state's 45% diversion goal. This estimate represents a capture rate of 34% of other recyclables from the disposal stream, and approximately 35,700 of those tons will need to be collected from the multi-family sector (Table 8).

Table 8: Additional Other Recyclables Collection via Drop Off (Tons)

COG	RESIDENTIAL SINGLE-FAMILY	RESIDENTIAL MULTI-FAMILY	COMMERCIAL & INSTITUTIONAL	TOTAL
1	72,700	17,300	110,500	200,500
2	4,700	900	7,000	12,600
3	8,200	2,300	13,300	23,800
4	4,400	900	6,500	11,800
5	8,700	1,800	12,400	22,900
6	6,700	2,200	11,200	20,100
7	11,500	2,400	20,200	34,100
8	19,000	4,800	29,200	53,000
9	2,100	300	3,100	5,500
10	4,800	900	7,100	12,800
11	800	100	1,300	2,200
12	2,600	500	5,100	8,200
13	1,200	200	1,800	3,200
14	4,400	1,100	6,700	12,200
<b>Total</b>	<b>151,800</b>	<b>35,700</b>	<b>235,400</b>	<b>422,900</b>

## ADDITIONAL ORGANICS AND COMPOSTABLES OUT OF DISPOSAL

An additional 1.0 million tons of organics and compostables, representing 33% of organic and compostable material in the disposal stream, will need to be collected from the single-family, multi-family, and commercial sectors as part of reaching the state's 45% diversion goal. Approximately 100,900 tons of the 1.0 million total tons of organics and compostable materials will need to be collected from the multi-family sector in Michigan where collection programs are currently extremely scarce (Table 9).

Table 9: Additional Organics (in Tons)

COG	RESIDENTIAL SINGLE-FAMILY	RESIDENTIAL MULTI-FAMILY	COMMERCIAL & INSTITUTIONAL	TOTAL
1	204,200	48,600	240,300	493,100
2	13,300	2,700	15,300	31,300
3	23,100	6,500	28,900	58,500
4	12,300	2,500	14,200	29,000
5	24,500	5,000	27,100	56,600
6	18,800	6,100	24,300	49,200
7	32,400	6,800	44,100	83,300
8	53,400	13,500	63,400	130,300
9	6,100	900	6,700	13,700
10	13,500	2,700	15,400	31,600
11	2,300	400	2,800	5,500
12	7,400	1,400	11,100	19,900
13	3,500	700	4,000	8,200
14	12,300	3,100	14,600	30,000
<b>Total</b>	<b>427,100</b>	<b>100,900</b>	<b>512,200</b>	<b>1,040,200</b>

Food waste encompasses 46% of the additional 1.0 million tons of organics needed for diversion. The second largest category of organics material for diversion is wood waste, which includes natural wood, treated and painted wood, lumber and engineered wood, and pallets. Due to the diversity of wood waste in the disposal stream, recovery of this material can be challenging. Compostable paper encompasses 17% of the additional needed diversion, and yard clippings encompasses 9% (Table 10).

Table 10: Total Additional Organics for Recovery by Material Type (Tons)

MATERIAL	TONS	PERCENT
Food	476,200	46%
Total Wood	293,400	28%
Compostable/Soiled and all other paper	173,700	17%
Yard Clippings - General	96,900	9%
<b>Total</b>	<b>1,040,200</b>	<b>100%</b>

## MULTI-FAMILY POTENTIAL RECOVERY

In total, 232,500 tons of additional recovery from disposal would need to be collected from multi-family residents as part of Michigan reaching the 45% diversion goal (Table 11). Approximately 41% of the additional collection would include mixed recyclables and 43% would be organics and compostables that could be collected single or dual stream on site or at drop-off sites. The remaining 15% of additional recyclables would likely need to be collected via drop-off sites (Figure 9).

Figure 8: Potential Percent Recovery from Multi-Family Generators

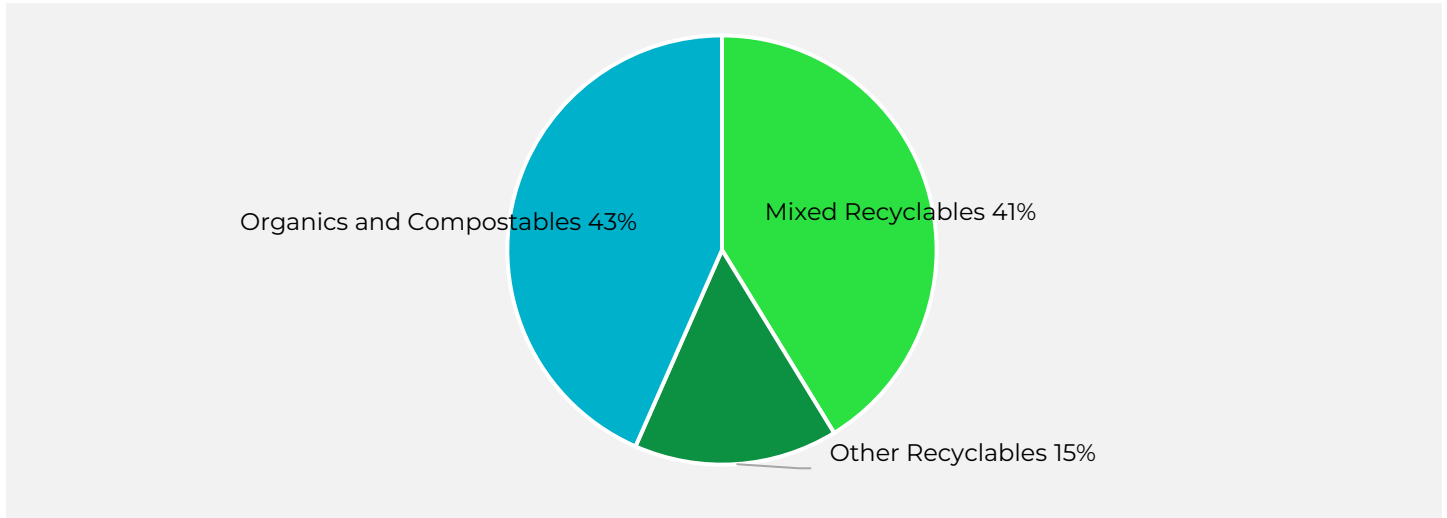


Table 11: Potential Tons Recovery from Multi-Family Generators

MULTI-FAMILY GENERATION	POTENTIAL CAPTURE RATE
Mixed Recyclables	95,900
Other Recyclables	35,700
Organics and Compostables	100,900
<b>Total</b>	<b>232,500</b>

## SECTION SUMMARY

- A total of 2.67 million tons of MRF compatible recyclables, other recyclables, and organics and compostables must be collected in Michigan to reach the 45% diversion goal.
- The additional recycling should be collected from all MSW generating sectors in Michigan, with approximately 54% coming from the commercial sector, 37% coming from single-family households, and 9% coming from multi-family households.
- In total, 232,500 tons of MRF compatible recyclables, other recyclables, and organics and compostables need to be collected from multi-family households across Michigan.
- Convenient access to recycling for multi-family households must be addressed to achieve Michigan’s diversion rate goals.



# DIVERSION PROGRAM ACCESS

Convenient and equitable access to diversion programs, such as recycling and organics curbside and drop-off programs, are the cornerstone to successful circular economy. The following section discusses the current state of diversion program access in Michigan with the purpose of informing EGLE of gaps in access that need to be addressed and opportunities to expand access and convenience throughout the state.

## RECYCLING ACCESS TO CURBSIDE AND DROP OFF

### CURBSIDE RECYCLING ACCESS

Curbside recycling is provided throughout Michigan in several ways. Communities may opt to collect recycling internally, utilizing municipal employees to provide service to households. Another option is contracting or franchising with private sector haulers to provide recycling service to all households within a given contract specification. Finally, residents may also receive recycling access through subscription services, meaning that recycling is offered by private sector haulers in the area and households may opt to sign up for the service.

Figure 9 presents a map of curbside recycling service by population and by type (municipal, contracted/franchise, subscription, and no curbside recycling access) available throughout the state of Michigan. The BRS requires that by 2025, communities with more than 5,000 residents must have curbside recycling services available to 90% of their single-family dwellings (House Bill 4454 2022). Communities that currently do not have curbside recycling services but will be required to under the BRS starting in 2025, are shown as dark grey circles. These communities as well as the subscription areas are potentially underserved.

Figure 9: Community Access to Curbside Recycling

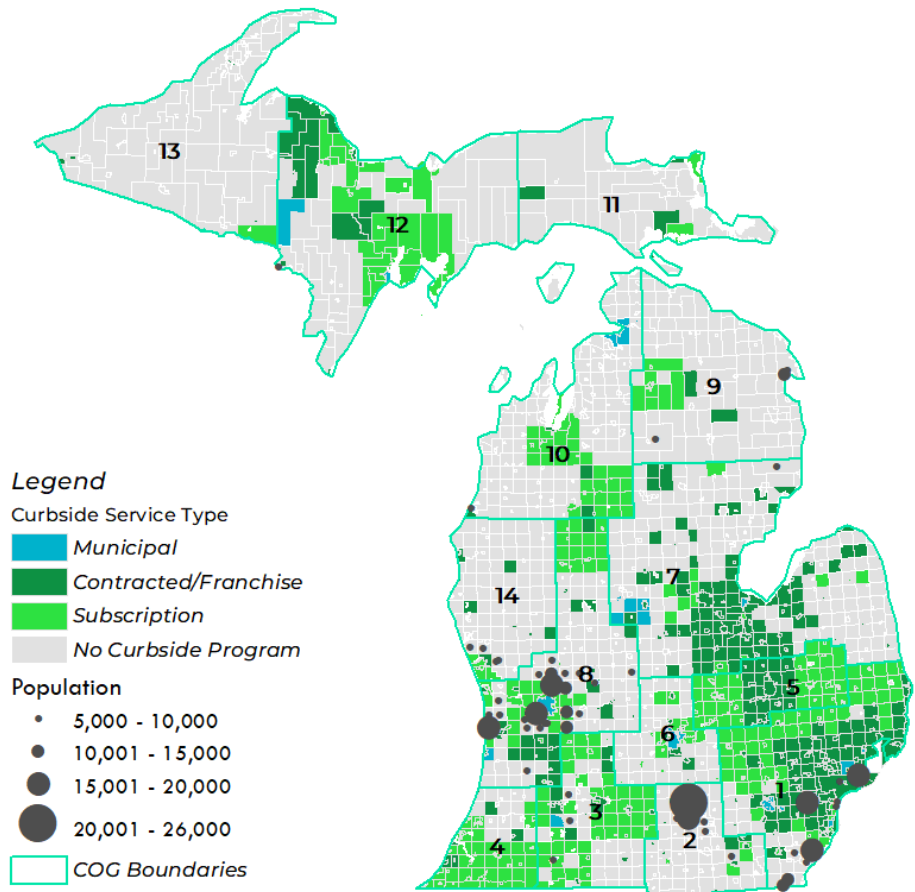


Figure 10: Curbside Service Type Available by Percent of Total Population

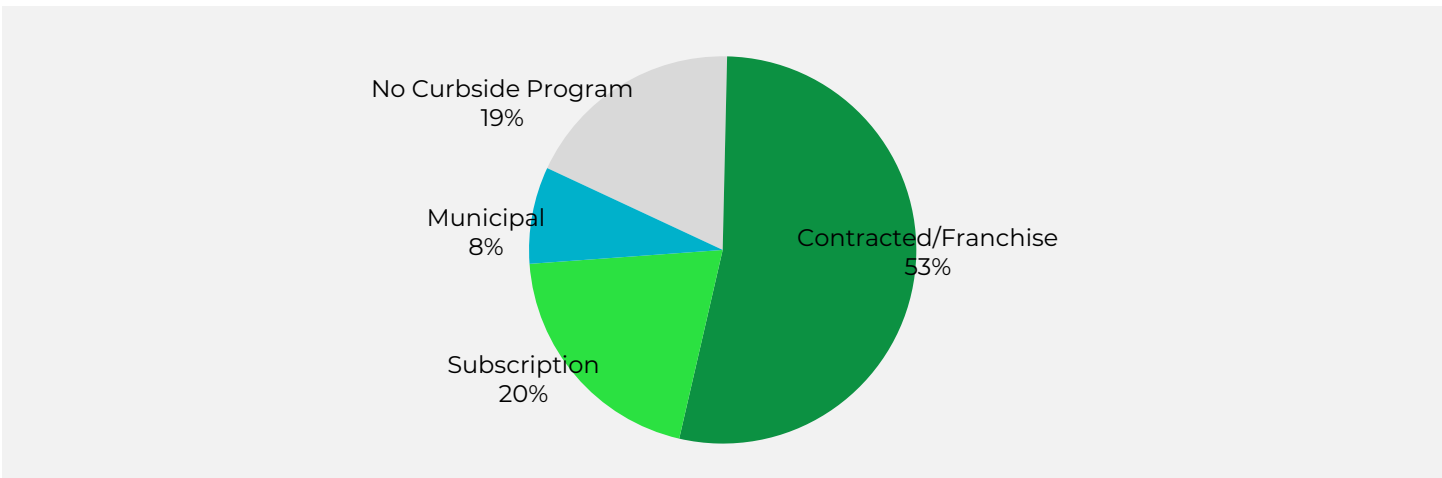


Figure 10 shows curbside service type and Table 12 shows curbside service type by population in the state. The majority of curbside service, representing access for 53% of the population, is provided via contracted or franchised agreements between a municipality, township, or authority and a private hauler. Approximately 20% of Michigan’s population receives recycling services through subscription programs, and 8% receive curbside recycling services provided directly by their municipality. Approximately 19% of Michigan’s total population, including single-family and multi-family residents, do not have access to curbside recycling.

Table 12: Curbside Service Type Available by Total Population

CURBSIDE SERVICE TYPE	POPULATION
Contracted/Franchise	5,365,252
Municipal	815,155
Subscription	2,040,675
No Curbside Program	1,856,249
<b>Total</b>	<b>10,077,331</b>

Figure 11 shows that for communities over 5,000 in population, the proportion of the total population without curbside access drops to 15%. A total of 300 communities with populations over 5,000 have curbside recycling programs, while 54 do not (Table 13).

Figure 11: Curbside Service Type by Total Percent for Communities Over 5,000 in Population

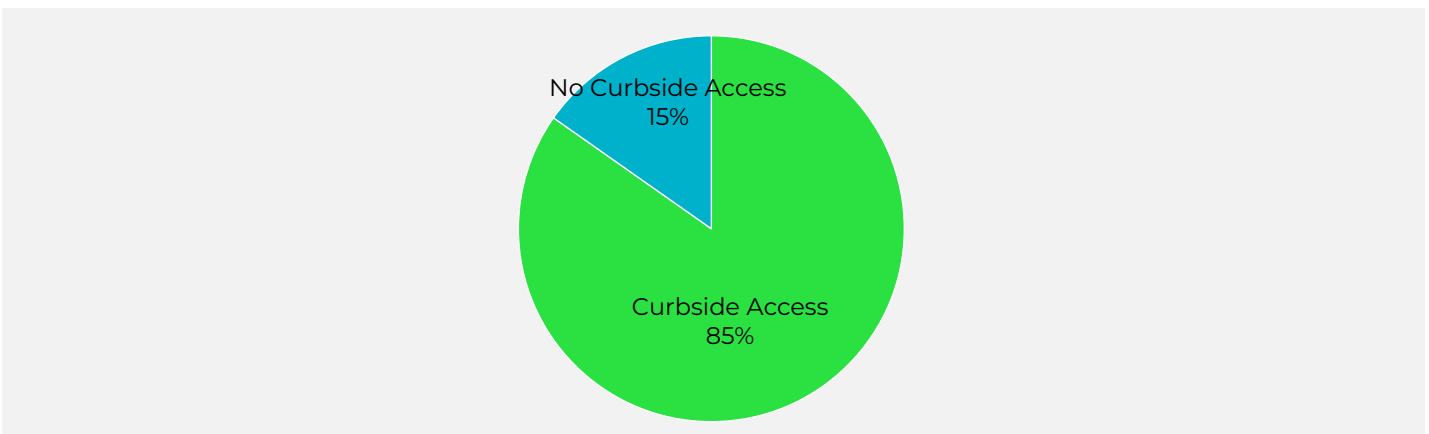


Table 13: Curbside Service Type by Total Communities for Communities Over 5,000 in Population

ACCESS TYPE OF COMMUNITIES OVER 5,000 IN POPULATION	COMMUNITY COUNT
Curbside Access	300
No Curbside Access	54
<b>Total</b>	<b>354</b>

Curbside recycling has traditionally focused on providing access to single-family households, and in Michigan approximately 93% of single-family households in communities with a population over 5,000 have access to curbside recycling, representing 2.2 million single-family households throughout the state (Figure 12 and Table 14).

Figure 12: Curbside Service Type for Single-Family Households by Total Percent for Communities Over 5,000 in Population

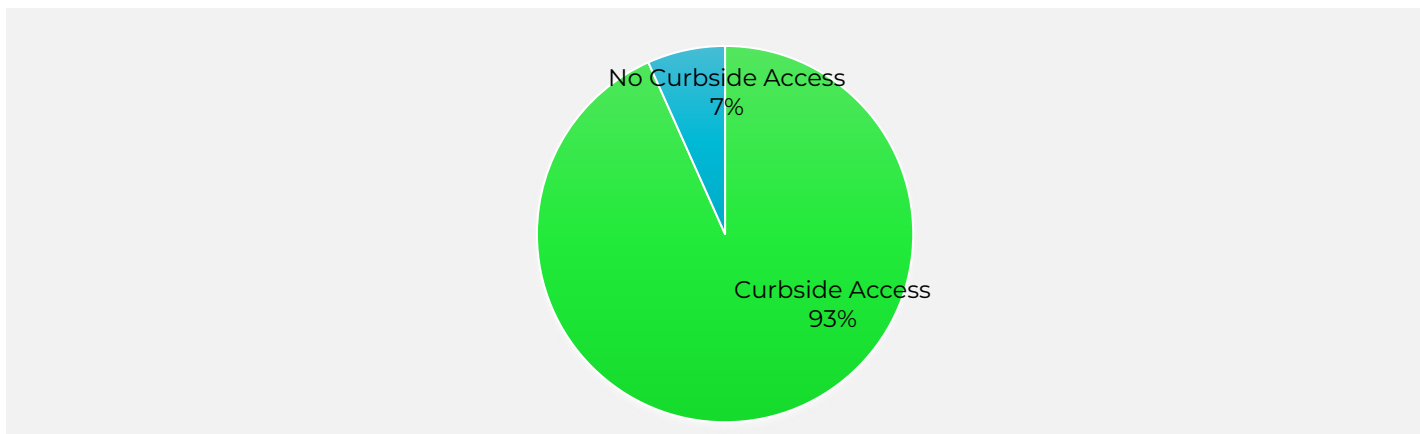


Table 14: Curbside Service Type for Single-Family Households by Total Households for Communities Over 5,000 in Population

SINGLE-FAMILY DWELLINGS IN COMMUNITIES OVER 5,000 POPULATION	HOUSEHOLDS
Curbside Access	2,269,619
No Curbside Access	159,469
<b>Total</b>	<b>2,429,088</b>

While recycling access is an important benchmark in measuring the progress towards Michigan's diversion goals, other critical factors such as participation and capture rates must also be considered. Truly reaching the state's goals will require that residents have access to recycling programs, participate in those programs, and correctly separate their recyclables from trash (capture rate). A typical household in the U.S. generates between 800 and 1,000 pounds of recyclables annually (The Recycling Partnership 2016). Recycling programs that provide the service automatically to residents without requiring the resident to sign up capture for recycling an average of 459 pounds per household annually of recyclables. In comparison, programs that requires residents to subscribe or sign up for service only capture on average 331 pounds per household annually of recyclables (The Recycling Partnership (TRP) 2020). The variation in capture rate for recycling between automatic recycling programs and subscription programs is primarily driven by participation rates, with participation rates and thus average capture rates lower for programs that require residents to take extra steps to join.

Another key factor in increasing capture rate of recyclable material in programs is ensuring residents have enough container volume to fit their weekly or bi-weekly recyclables. Programs that distribute carts to residents which are generally larger and more easily maneuverable than a bin capture on average 459 pounds per household of recyclables annually, while programs where residents only have smaller capacity bins capture on average 360 pounds per household annually (The Recycling Partnership (TRP) 2020).

Finally, education and outreach to inform residents on how to participate in the recycling program and what to put in the recycling stream is critical to maximizing both participation and capture rates. A 2019 campaign launched in Sarasota, FL demonstrated the impact of moving to carts and continuous education and outreach to residents. The City engaged in a campaign to rollout recycling carts to residents, switching from 18-gallon bins. During the rollout the City provided residents with educational material on how to use their new carts. Over the course of the rollout campaign, the City measured a 75% participation rate in the program and saw a 71% increase in recycling volume from the previous year. Additionally, the incoming recyclable material had a low contamination rate as residents knew what to put in and keep out of their carts (The Recycling Partnership (TRP) 2020).

## DROP-OFF RECYCLING ACCESS

Drop-off programs are a vital recycling pathway for multi-family and rural residents that lack access to curbside recycling. They have the potential to provide all residents and businesses with a broader range of recycling options than traditional curbside can offer (e.g., recycling of textiles, electronics, film, mattresses, furniture, and more). Tracking of drop-off recycling programs in Michigan was extremely limited prior to the Michigan Materials Management Infrastructure and Programs Project (Mega Data Project), which started in 2019. The Mega Data project collected information on drop-off programs throughout the state.

Figure 13 presents the results, differentiating between community- and county-based programs, where there are restrictions on who can use the drop-off sites, and “open to all” sites that allow anyone to utilize the facility. It is important to note that the BRS for drop-off access only focuses on residents *without* curbside recycling at their dwelling, while in this analysis RRS looked at *all* drop-off access, even in communities with curbside, as drop-offs can often accept greater material types and serve multi-family and surrounding rural residents. Also note that the range of materials accepted at drop-off sites varies widely and is not delineated in these results, however, the potential for drop-off sites to increase the types of materials accepted and the need to expand the number of drop-off sites that accept a comprehensive range of materials represents an opportunity to increase diversion.

Figure 13: Community Access to Drop-Off Recycling Program

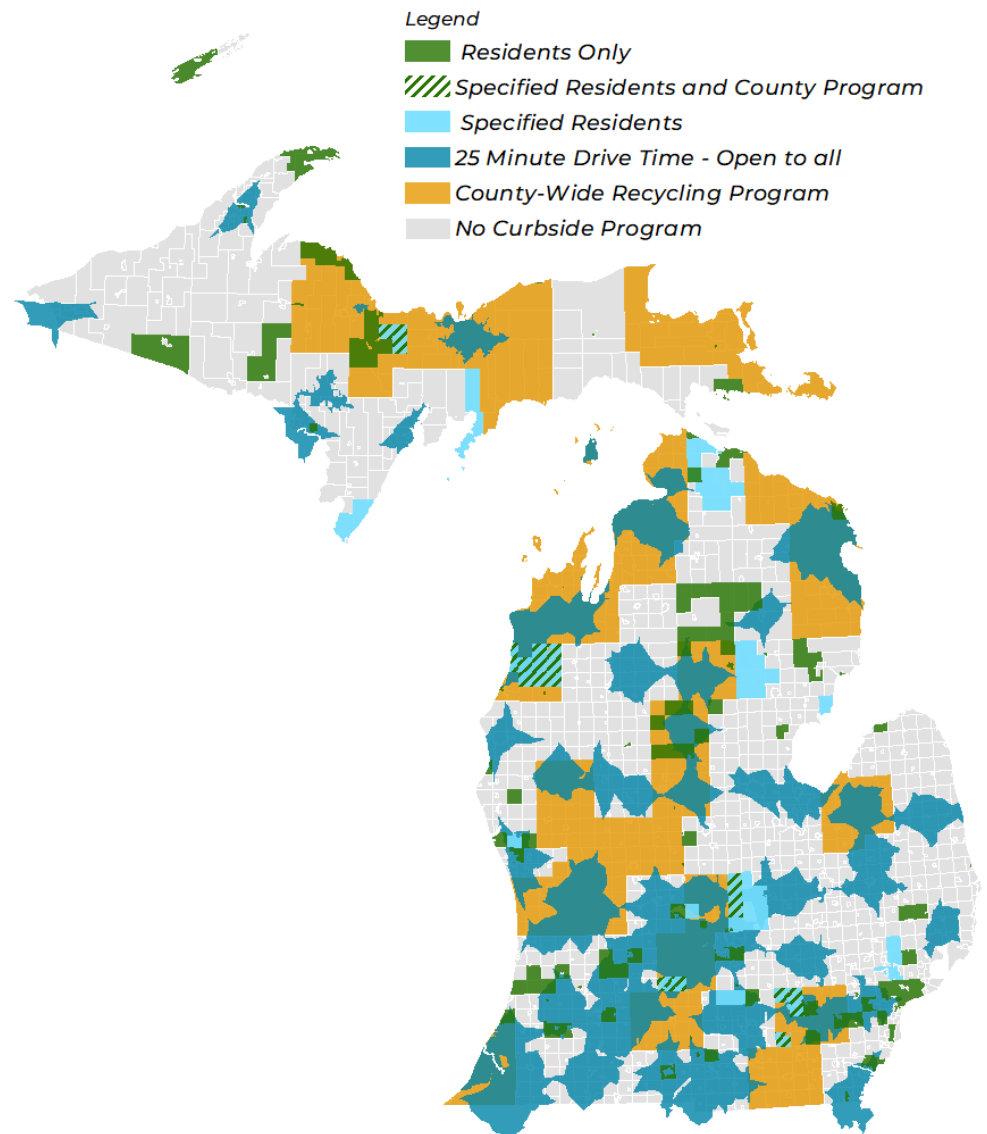


Figure 14: Breakdown of Drop-Off Access Type for Population with Access and Table 15 show drop-off recycling service type by population.

Figure 14: Breakdown of Drop-Off Access Type for Population with Access

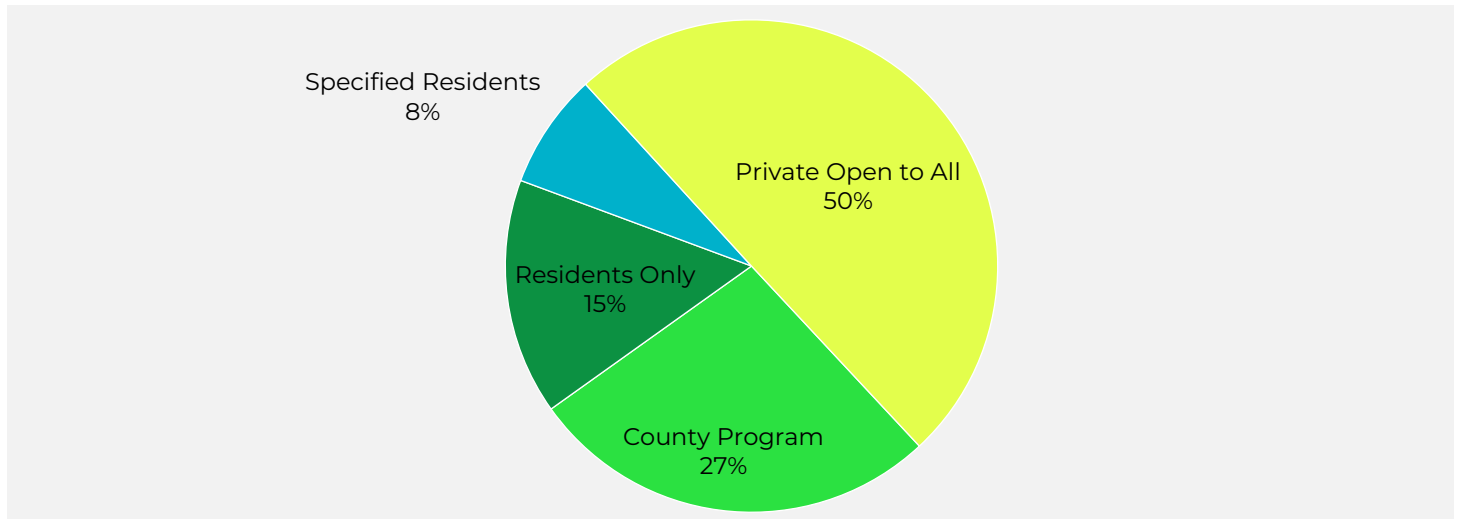


Table 15: Total Population with Drop-Off Recycling Access

DROP-OFF ACCESS TYPE	POPULATION WITH ACCESS <sup>17</sup>
County Drop-Off	2,320,903
Residents Only	1,329,445
Specified Residents	649,226
Private Open to All Facility	4,270,118
No Drop-Off Access	2,652,238

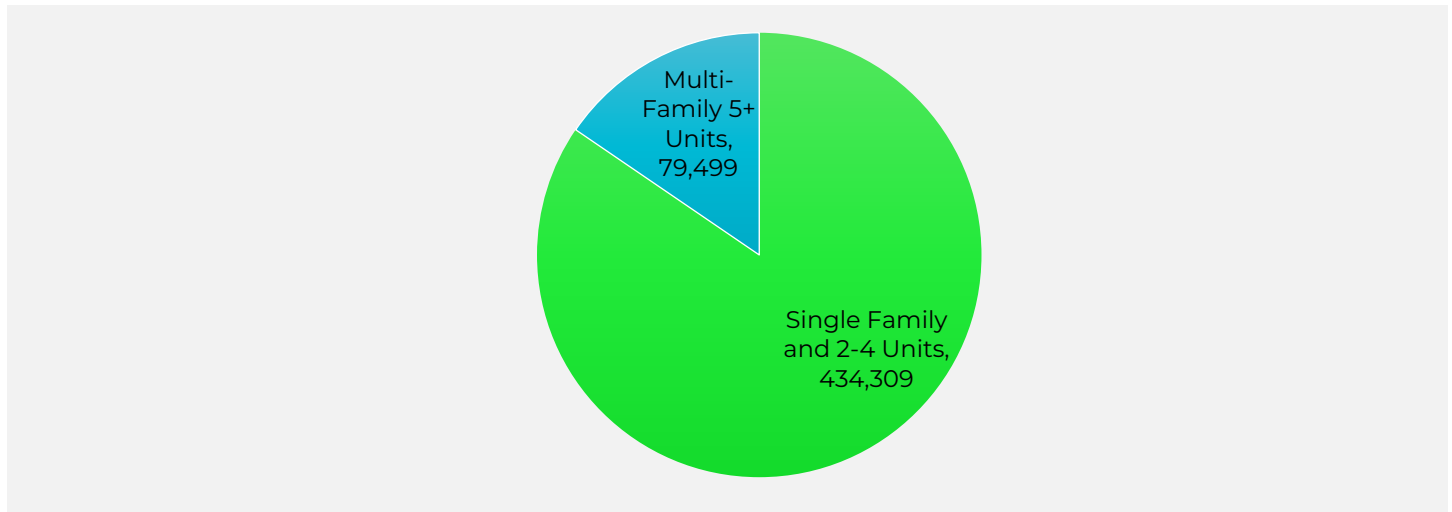
<sup>17</sup> Figure 13 shows that drop-off areas are frequently overlapping. Therefore, the table in table 15 will not be equal to the population of the state as many communities have access to multiple kinds of drop-offs.

## RECYCLING ACCESS BARRIERS

### AREAS OF NO CURBSIDE OR DROP-OFF RECYCLING ACCESS

In total, approximately 513,808 Michigan residents do not have access to either curbside or drop-off recycling programs, accounting for 5% of Michigan's total population. Of the residents living in communities without curbside or drop-off recycling programs, 434,309 (85%) are residents in single-family households and 79,499 (15%) are residents in multi-family households (Figure 15). Many of the communities without any recycling access are small communities with an average population of 3,169 people. Residents in communities without any meaningful access to recycling would be able to participate in some recycling through Michigan's DRS, but recycling outside any statewide recovery system would likely be out of reach.

Figure 15: Total Population without Drop-Off or Curbside Access



### AREAS OF NO DROP-OFF RECYCLING ACCESS FOR MULTI-FAMILY RESIDENTS

Multi-family properties of 5+ units are often unable to participate in standard curbside recycling programs. The map in Figure 16 shows the population of multi-family residents. Generally, these are populations which are not served by single-family curbside services.

With multi-family residents left out of curbside recycling programs, drop-off recycling programs are often the only access to recycling for multi-family households. In total, 405,395 multi-family residents live in communities without any drop-off recycling access, representing 24% of the state's multi-family population (Figure 17).

Figure 16: Map of Multi-Family Population in Michigan

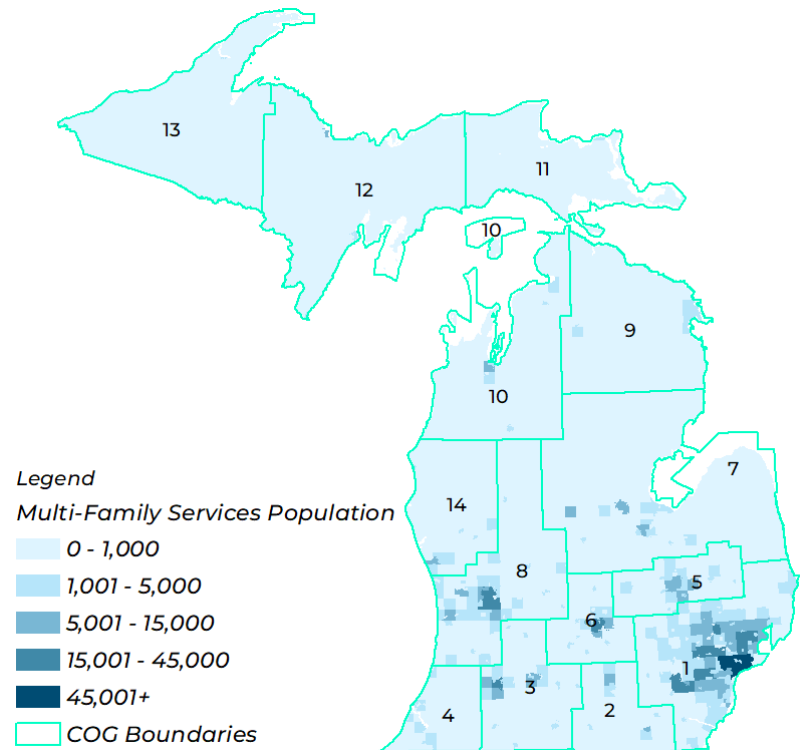
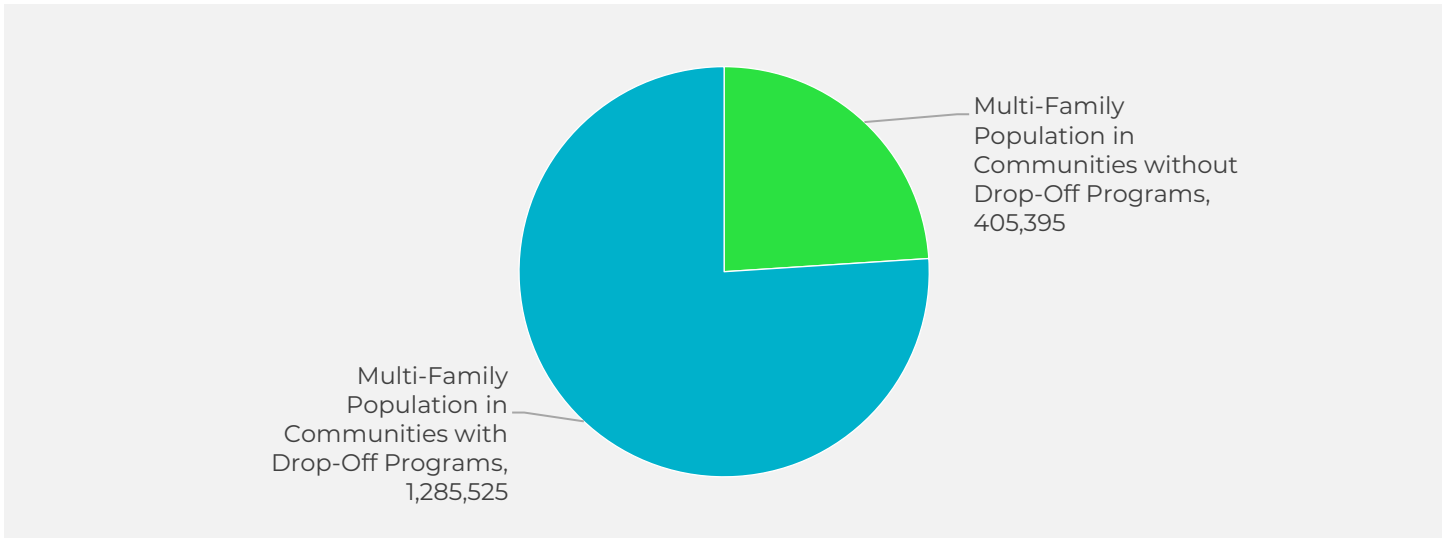


Figure 17: Multi-Family Population and Access to Drop-Off Recycling



### EQUITABILITY OF RECYCLING ACCESS

RRS analyzed availability of curbside recycling access across Michigan cities, villages, and townships and their median income. The goal of this analysis was to benchmark whether community income, an indicator of ability to pay for recycling services, impacts the availability of recycling programs. While this analysis does not directly tie the community to an environmental justice score, the EGLE’s MiEJScreen interactive mapping tool<sup>18</sup> shows a strong correlation between the median income of a U.S. Census tract and the tract’s MiEJScreen score, with higher median income corresponding to lower environmental hazards (see Appendix for Diversion Program Access Table 59).

Table 16 shows the average median household income by quartile in the state.<sup>19</sup> In the lowest quartile, Q1, the average median household income is \$43,323,<sup>20</sup> whereas in the highest quartile, Q4, the average median household income is double at \$87,877. For reference, the median household income across Michigan is \$59,688.

Table 16: Average Household Median Income by Quartile in Michigan

QUARTILE	AVERAGE MEDIAN HOUSEHOLD INCOME OF QUARTILE
Q1	\$43,323
Q2	\$55,074
Q3	\$65,403
Q4	\$87,877

Statewide communities within the top quartile of median income in Michigan are 2.6 times more likely to have access to curbside recycling than communities within the bottom quartile of median income. Breaking the data down further into rural, suburban, and urban sized communities, a similar access pattern emerges where communities with higher median incomes are more likely to have curbside recycling access than communities with lower median incomes.<sup>21</sup> Figure 18 shows the likelihood of a community having a recycling program compared to the average median income in each quartile, Q1 through Q4. In all cases, the lowest income communities were less likely to have access to curbside recycling programs whether rural, suburban, or urban, than higher income communities. For example, the highest income suburban communities are 3.3 times more likely to have access to curbside recycling than the lowest income

<sup>18</sup> <https://www.michigan.gov/egle/maps-data/miejsscreen>

<sup>19</sup> In this document a quartile is defined as four equal groups of median household income into which the Michigan population can be divided.

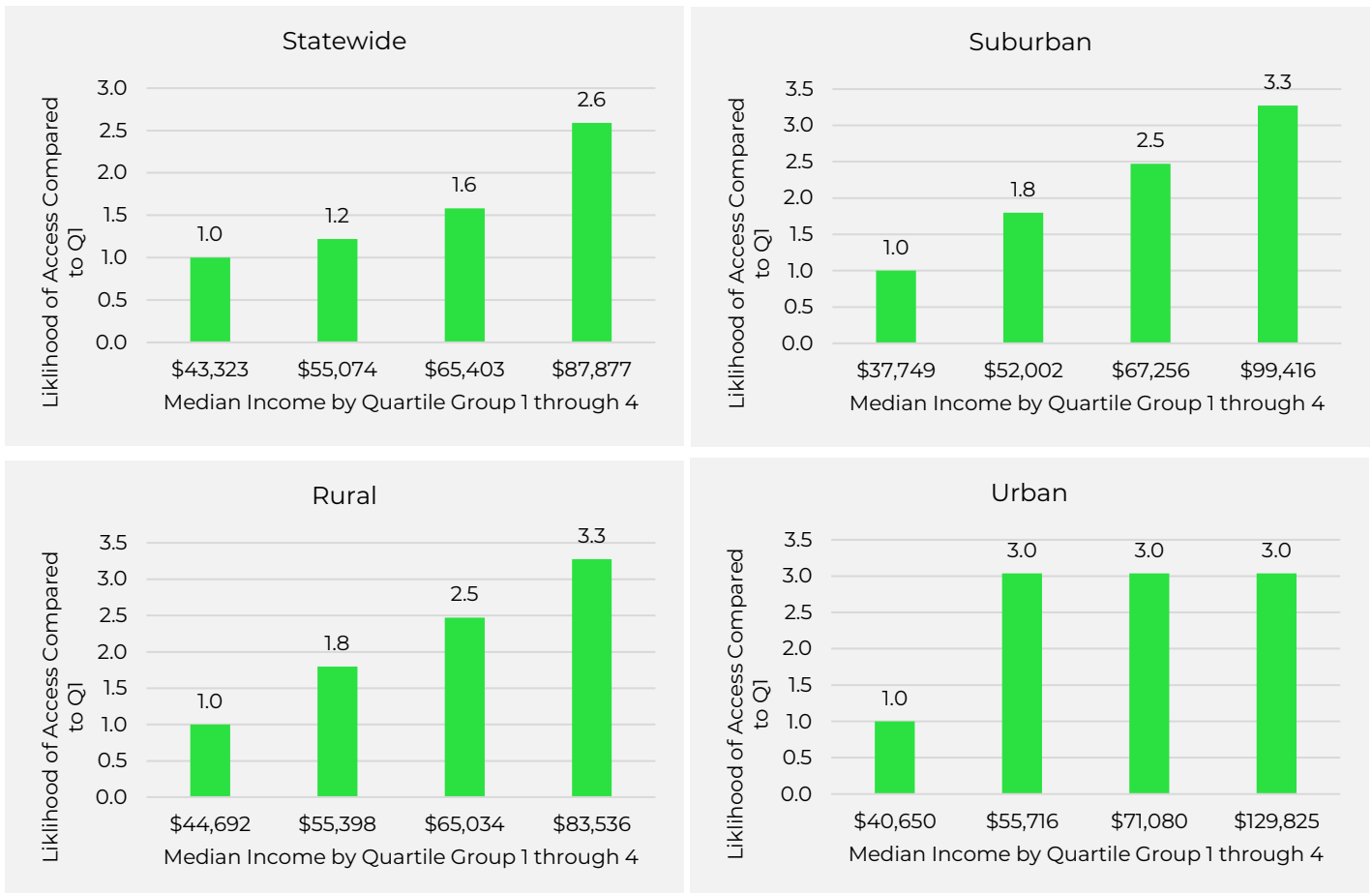
<sup>20</sup> Household Median Income past 12 months, US Census 2021 ACS 5-Year Estimate.

<sup>21</sup> Rural communities were defined as having 500 people or fewer per square mile. Suburban communities were defined as having 501 to 3,000 people per square mile. Urban communities were defined as having 3,001 or more people per square mile.

communities. As community income increases, the likelihood of access to curbside recycling also increases. An exception to this is in urban areas where access is lower only for the lowest median income quartile and access for Q2, Q3, and Q4 of urban areas is comparable.

The above analysis shows that areas of higher income are more likely to have access to curbside recycling services than areas of lower income, likely reflecting a community's ability to pay for an additional service above and beyond waste collection. EGLE's goal is to expand recycling access across the state so that recycling becomes as easy as disposal throughout the state. To fully realize that goal, EGLE will likely need to provide additional financial support to lower income communities to support equitable access to recycling programs. EGLE has already begun to do this with investments in Benton Harbor, Detroit, Pontiac, Flint, and communities in northern Michigan and the Upper Peninsula. In just Wayne, Macomb, and Oakland Counties, over \$4.3 million in recycling infrastructure and market development grant funds have been awarded since 2019, with over \$1 million in 2022. Investment includes supporting solutions through the sixteen NextCycle Michigan teams impacting those same counties. Combined investment and strategic support are helping these communities bring in jobs while supporting the circular economy. Investment on the other side of the state includes \$1 million in funding to support efforts of the City of Benton Harbor to invest in their transfer station and, aligned with participation in NextCycle Michigan, related recycling activities. As the City of Benton Harbor has navigated water issues, EGLE made an investment in recycling for plastic water bottles, aligning with their Environmental Justice work. Similar activity is also reaching rural areas; in the past few years over 23 different initiatives started in the Upper Peninsula to implement and scale recycling, totaling \$20 million in investment so far. Many of the northern Michigan and Upper Peninsula communities are navigating rural challenges, but programs like NextCycle, catalyst communities, and other EGLE efforts are supporting new opportunities.

Figure 18: Statewide Likelihood of Curbside Recycling Access Compared to Quartile 1 (Q1)





## ORGANICS COLLECTION ACCESS

Yard clippings, sometimes referred to as yard waste, which includes grass, leaves, sticks, and landscape trimmings are the organic components of the MSW stream most often considered for collection at the residential curb due to the Michigan yard clippings landfill ban. Thus, most organics programs in the state target the collection of yard waste only, either year-round or, more often, seasonally. However, as shown in the Potential Recovery section of this report, food waste comprises nearly half of the additional organics and compostables that need to be diverted to reach Michigan's 45% diversion rate goal.

Across the U.S. collection of organics from residential and commercial sources is growing as more and more communities seek to increase their overall recovery levels. Downtown commercial districts with a dense clustering of restaurants provide an opportunity to collect food waste more efficiently than food waste for residential curbside. Food waste only collection programs for residential (also known as household organics, or HHO) are quite rare. Innovative collection schemes, ranging from bicycles to depreciated packer trucks have been used to provide residential users options for the collection of curbside residentially generated food waste. Other initiatives have shown that most successful programs find a means of co-collecting food waste with yard clippings; this provides an effective cost outcome as well as collecting from households in a downtown area on the same route with commercial food waste.

## FOOD WASTE COLLECTION

There are 19 known food waste drop-off locations in the state (Table 17). Ottawa County is an example of such a program and has multiple sustainability centers which offer residents and small businesses within the county to dispose of food waste (Ottawa County 2023). Additionally, the City of Ferndale has five drop-off sites for residential food waste, and Emmet County has food waste drop-off at Pleasantview Road Transfer Station-Compost Site and at their downtown market (Ferndale 2023; Emmet County Recycling 2023).

In addition to drop-offs, multiple curbside food waste-specific haulers exist in Michigan. A handful of haulers serve residents, businesses, and institutions in communities throughout southern Michigan. Areas with municipal food waste collection programs include Ann Arbor (co-collected with yard clippings) and Emmet County (for commercial businesses). Regions with private subscription-based curbside collection programs include Detroit, Saginaw, Grand Rapids, Lansing, Benton Harbor, Traverse City, and a potential future private curbside program is being developed in the Marquette County region. Table 17 below shows the total number of food waste drop-off sites and haulers in Michigan and a list of each of them is in the Appendix Diversion Program Access.

Table 17: Food Waste Haulers and Food Waste Drop-Off Sites

CATEGORY	COUNT
Food Waste Drop-Off Site	19
Food Waste Haulers	16

The following spotlights of food waste specific haulers (and some are also compost processors) in Michigan highlights success stories and opportunities for additional growth in this sector.

- **Wormies** – Wormies ([thewormies.com](http://thewormies.com)) came into NextCycle seeking to expand its vermicompost operation in West Michigan by developing a new 13-acre site to increase production of its highly sought-after premium soil amendment. During the track experience, NextCycle coaches and mentors helped Wormies design the new site and began the process of getting the site permitted. Wormies secured an EGLE Market Development Grant to help finance this growth. Following coaching by NextCycle mentors, Wormies CEO Luis Chen Aguilera won the FLOWS (food, liquids, and organic waste) Showcase Judge's Award. (NextCycle 2023). In addition to processing organics, Wormies offers residential and commercial collection of food waste. Wormies is a minority-owned business and one of only 2 food scrap composting companies in the Grand Rapids region. They collect food scraps from over 600 residential and commercial customers. They offer a unique micro-hauling solution, using five-gallon buckets, a size that fits the needs of most residential customers. With the help of NextCycle Michigan, they have now increased their hauling capacity to serve an additional 2,500 customers. More than half of the food waste collected by Wormies is delivered to local farms in the area to be composted and used by those farmers.

Wormies operates as a “community composting farm” supplying a portion of the compost they produce at Wormies Farm to their collection customers and donating soil products to urban community gardens (NextCycle Michigan 2022).

- **My Green Michigan** – My Green Michigan ([mygreenmi.com](http://mygreenmi.com)) is an established but growing company in the organics industry that is working to operate at full capacity by increasing customers and material intake. (NextCycle 2023). My Green Michigan is a NextCycle FLOWS alumni and gained market insights and growth through being a participant in the program. My Green Michigan collects food scraps and compostable foodservice products in rolling carts and dumpsters from commercial and institutional customers throughout southern lower Michigan and delivers the collected material to partnering industrial compost processing facilities in Wixom and Dimondale, Michigan (MyGreen Michigan 2023).
- **Scrap Soils** – Scrap Soils ([scrapsoils.com](http://scrapsoils.com)), also a NextCycle FLOWS alumni, is a Detroit-based organics collection service provider for residential and commercial customers. Scrap Soils provide weekly collection via membership and delivers the food scraps to a local composting facility that processes the food scraps with wood chips to create compost (Scrap Soils 2023).

## YARD CLIPPINGS COLLECTION

Approximately 59% of the state population has a curbside yard clippings collection program (Table 18). Most of the communities have spring through fall pickup. Yard clippings programs by hauler are shown in Table 19. Categories are defined as municipal, private, and private-large. Private-large haulers include Waste Management (WM), Republic Services, and Green for Life (GFL).

Table 18: Communities with Yard Clippings Collection

CURBSIDE YARD CLIPPINGS SEASON	PERCENT OF POPULATION WITH ACCESS	PERCENT OF STATE POPULATION
Fall Leaf Only	4%	2%
Spring-Fall Only	95%	56%
Year Round	1%	1%
<b>Total with Access</b>	<b>100%</b>	<b>59%</b>

Table 19: Hauling Services for Yard Clippings

CATEGORY	HAULER COUNT
Municipal	37
Private	26
Private - Large	3
<b>Total</b>	<b>66</b>

Yard clippings account for 88% of currently recovered organics, demonstrating the success of Michigan’s yard clippings landfill ban to promote collection and diversion. Curbside programs are the key contributor to yard clippings diversion because they provide access to collection in the seasons of greatest generation (i.e., fall leaves, spring-fall yard clippings) and some programs operate year-round. Collection is provided via carts, paper yard bags, bundling, or a combination of all three. Some communities also provide storm debris collection in addition to the regular yard clippings collection.

The analysis of yard clippings collection is not a focus of this report, but it is important to mention the success of these programs for landfill diversion and how the yard clippings collection infrastructure in place can lead to expanded collection of residential food waste. For communities that provide collection via carts, there is an opportunity to add food waste to yard clippings collection, especially in the communities that collect year-round. For those that provide only spring through fall service, food waste can be added to the carts over the winter months and when spring collection

arrives, the full carts are picked up for processing<sup>22</sup>. The City of Ann Arbor initially allowed food waste in carts over the winter with success and has now moved to once a month collection of organics carts during the winter to handle storm debris and food waste. The challenges, and opportunities, for communities to move to co-collection of food waste and yard clippings include collection via curb carts, year-round collection, policy to restrict food waste in the waste stream, and education for awareness to reduce contaminants such as non-compostable packaging while increasing diversion.

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## SECTION SUMMARY

### CURBSIDE RECYCLING ACCESS

- 93% of single-family households in communities with a population of 5,000 or greater have access to curbside recycling, demonstrating Michigan's success in rolling out curbside recycling programs to single-family households in populated areas, although there is still some work to be done to ensure 100% access.
- On-site recycling programs for multi-family households, considered equivalent to curbside recycling, are sparse and most multi-family residents currently must rely on less convenient recycling drop-off sites.

### DROP-OFF RECYCLING ACCESS

- Drop-off recycling often provides the only recycling access to multi-family and rural residents. Drop-off programs can also provide access to diversion for other recyclables incompatible with MRF processing to all residents. Drop-off recycling access is provided to many residents across Michigan in a number of ways including privately run drop-off sites, and sites operated at the municipal, township, and county level. While drop-off recycling is common in Michigan, 2.65 million Michigan residents lack access to a drop-off recycling program.

### RECYCLING ACCESS BARRIERS

- 513,808 Michigan residents (5%) do not have access to either curbside or drop-off recycling programs.
- 24% of multi-family residents in Michigan live in communities without drop-off recycling programs.
- The highest income communities in Michigan are three times as likely to have curbside recycling programs as the lowest income communities, indicating that ability to pay for recycling services is impacting equitable access.

### ORGANICS COLLECTION ACCESS

- More than half, 59%, of Michigan's population has some level of access to curbside organics collection. The vast majority of these programs are seasonal yard waste collection. Reaching a 45% diversion rate in Michigan will require a large focus on capturing food waste out of the MSW stream. Some food waste may be able to be added to existing curbside yard waste collection programs.

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<sup>22</sup> Note, it is important for the receiving composting facility to have a stockpile of fall leaves on which to unload the food waste and create the appropriate mix for well-managed composting.

# PROCESSING INFRASTRUCTURE

Recovery infrastructure includes MRFs, organics processing facilities, and transfer stations. Achieving the 45% goal will require expansions in both recycling and organics processing, particularly for food waste. This section of the report describes the current state of MRF and organics processing infrastructure in Michigan, the hubs for diverted material in the state. Additionally, this section assesses the relationship between waste and diversion infrastructure and environmental justice.

## MRF PROCESSING

### MRF FACILITY OVERVIEW

#### MRF THROUGHPUT

Since the 2020 Gap Analysis, RRS estimates that MRF capacity in the state has increased by approximately 95,900 tons. Overall, it is estimated that the current throughput of curbside and drop-off materials going to MRFs is 411,450 tons per year, based on the design throughput capacity when available via interviews and website research, or on reported current throughput (Table 20 and Figure 19). The 2022 processing capacity is less than what was reported in the 2021 Gap Analysis which estimated Michigan's processing capacity at 440,828 tons per year, however this most likely reflects better data quality for MRF processing in 2022 which includes direct reporting from select MRF operators rather than estimating based on facility capacity.

Table 20: MRF Throughput by COG (Tons)

COG	2022 MRF THROUGHPUT
1	231,724
2	0
3	0
4	9,200
5	0
6	3,496
7	21,912
8	91,860
9	402
10	39,800
11	2,122
12	10,934
13	0
14	0
<b>Total</b>	<b>411,450</b>

Figure 19: MRF Processing Map

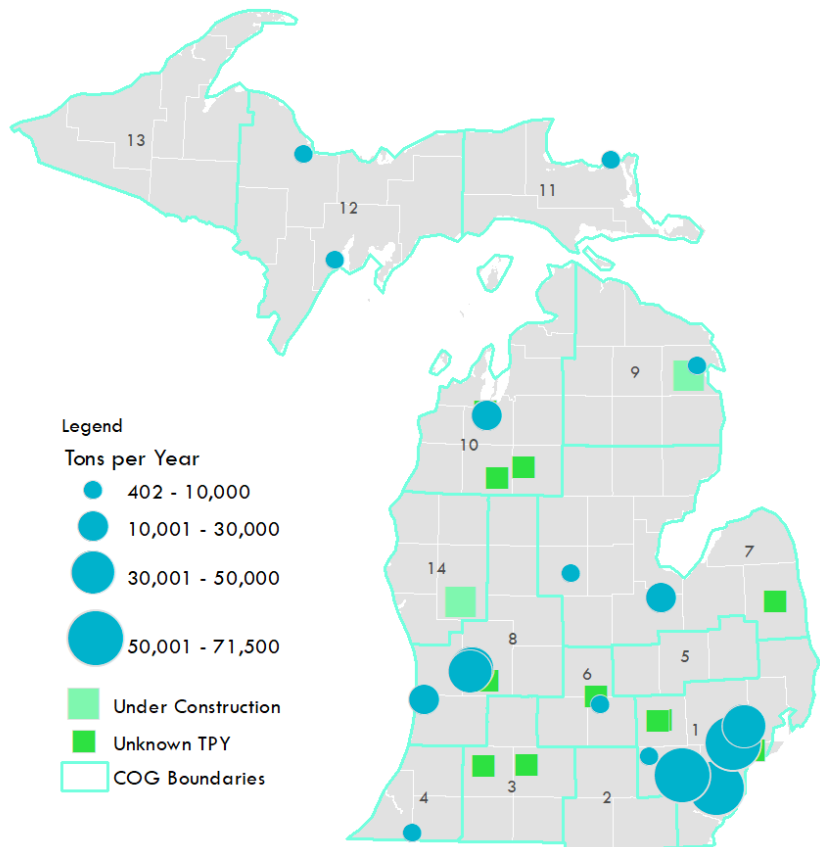


Table 21 compares Michigan’s current and needed MRF processing as part of achieving the state’s goal of a 45% recycling rate. An additional 1.2 million tons of mixed recyclables<sup>23</sup> will need to be processed to achieve the state’s recycling goal.

Table 21: Comparison of Current (2022) MRF Processing and Needed MRF Processing (Tons Per Year)

COG	CURRENT MRF PROCESSING	NEEDED MRF PROCESSING
1	231,724	570,300
2	0	36,100
3	0	67,800
4	9,200	33,400
5	0	65,200
6	3,496	57,000
7	21,912	97,500
8	91,860	150,500
9	402	15,700
10	39,800	36,600
11	2,122	6,400
12	10,934	23,600
13	0	9,300
14	0	34,600
<b>Total</b>	<b>411,450</b>	<b>1,204,000</b>

MRF throughput in Michigan has primarily increased due to additional facilities coming online and is not driven by existing MRFs increasing capacity. An example of efforts towards this goal includes the new MRF in Alpena County, Michigan that will come online 2024-2025 to support the current and future need for recycling processing capacity in the northern Lower Peninsula. This project is spearheaded by a regional Solid Waste Authority who has partnered with organizations such as Closed Loop Partners, The Recycling Partnership, and the Environmental Protection Agency. The MRF will be dual stream and have a designed processing capacity of 4,200 tons per year with the possibility of processing up to 6,000 tons per year in the future. The facility will utilize high efficiency sorting technology from Revolution Systems and is intended to be a hub for surrounding communities’ collection programs.

The new MRF in Alpena County could serve as a model for other regions in need of additional processing capacity, particularly for rural areas, and signifies a new partnership opportunity for material collection. Infrastructure development, such as this MRF, plays a significant role in the ability of communities to establish and maintain robust recycling programs.

## INTERVIEWED MRFS

To gain a more detailed snapshot of existing MRF operations and updates since the previous Gap Analysis, RRS conducted interviews from July to September in 2023 with key contacts representing eight different MRFS across the state. The interviews included representatives from single stream and dual stream MRFS, as well as source-separated commercial facilities, with public and private ownership and operational statuses. The list of interviewed facilities and interview questions can be found in the Appendix for Interviewed Material Recovery Facilities.

## ESTIMATED THROUGHPUT

As aligned with the Statewide MRF throughput analysis above, the MRFS interviewed by RRS indicated that their throughputs have not significantly changed in the past three years, and many continuously operate below their facilities’ designed capacities. The interviewees expressed interest in increasing their facilities’ throughputs to narrow the gap between their current and designed processing capabilities. However, they highlighted barriers to increased throughput

<sup>23</sup> Mixed recyclables refer to recyclables traditionally processed at MRFS such as mixed paper, cardboard, plastic bottles and jugs, aluminum and steel cans, and glass containers.

such as staffing limitations, equipment and facility needs, and end market availability that have discouraged them from pursuing these efforts. A summary of capacity information for the MRFs interviewed can be found in Table 22.

Table 22 Interviewed MRFs' Processing (Tons Per Hour)

MRF	CURRENT	DESIGNED
1	15 – 18	20
2	10 – 15	22
3	14	14
4	9	15
5	4	4 – 9
6	18 – 22	18 – 22
7	7 – 8	13 – 15
8	3 – 5	10

These MRFs only represent a portion of the state's throughput but continuing efforts to build out capacity statewide is essential to meet the needs of Michigan communities and commercial entities' new and expanding recycling programs. Under the BRS, many communities will also be required to establish or expand curbside and drop-off recycling programs, which will lead to more material processing at new and existing MRFs throughout the state.

### STAFFING AND HOURS

Similar to MRF throughput, RRS' interviews revealed that MRFs' operating hours and shift utilization have been fairly static in recent years, other than minor hours or staffing changes during busier seasons of material collection. The interviewed facilities operate four to five days per week and utilize one shift of six and a half (6.5) to ten (10) hours per day. Facility hours and shift information from the interviewed MRFs are summarized in Table 23. While this table does not capture all Michigan MRFs operational information, it provides an overview of trends seen throughout the state.

Table 23: Interviewed MRFs Operational Hours and Shifts

MRF	DAYS PER WEEK	HOURS PER DAY	SHIFTS PER DAY
1	5	8	1
2	5	6.5 – 7	1
3	5	9	1
4	5	10	1
5	4	10	1
6	5	8.5	1
7	5	10	1
8	5	8	1

Due to the state's evolving recycling landscape, many interviewed MRF contacts conveyed interest in increasing facility hours and shifts to meet growing demand. However, they also shared anecdotal evidence that this endeavor would be too challenging to approach under their current economic and infrastructural circumstances.

Budget limitations and overhead costs currently restrict the facilities' ability to hire new staff and operate equipment for longer periods. Several interviewed MRF contacts also emphasized concerns over the labor market and ongoing challenges in recruiting and retaining skilled labor at their facilities. This limits the ability to adequately operate any facility beyond its current hours.

In summary, MRF operational hours and shift utilization have not notably changed at the interviewed facilities over recent years, but there is interest increasing facility hours and subsequent staffing with proper support. It is recommended that EGLE explore funding opportunities to support MRF staffing and facilitate operational growth to continue building out capacity in areas with new and existing MRFs.

## EQUIPMENT

In addition to understanding MRF throughput and operational changes, RRS investigated equipment updates made at the interviewed facilities. Most of these have utilized equipment such as horizontal or vertical balers, disc screens, and optical and manual sorters for many years to process incoming materials. Some facilities have also targeted specific materials like metal and glass with eddy currents, magnets, or air-knives.

While some interviewed facilities noted adding or retiring balers since the last Gap Analysis, the most remarkable update to equipment at these facilities has been the incorporation of AI technology for material sorting. AI sorting robots, from companies such as Machinex and AMP Robotics, have been installed in many of the interviewed facilities.

All of these facilities shared that their robots have resulted in significantly more efficient processing and cleaner material streams for their end markets. The Emmet County MRF interviewee, for example, stated that they have seen significant benefits from adding AI robots to their operations. Their team regularly receives data from the robot manufacturer, AMP Robotics, which provides insight on the facility's material streams and opportunities for improvement (e.g., missed or improper sorting); using this data, Emmet County staff will work with AMP Robotics to adjust the robot's specifications and capture more or less particular materials.

Many of the MRFs interviewed want more of these robots in their facilities; however, all reiterated the need for funding and implementation support from public and private partners. The length of time it takes for a facility to evaluate, purchase, and install new technology should also be considered. The interviewed facilities stated that it is a time consuming endeavor, which is frequently exacerbated by supply-chain issues or lengthy funding allocation processes.

## RESIDUAL RATES AND MATERIALS

In addition to the interviews with Michigan MRFs, RRS conducted MRF residuals characterization studies in several facilities throughout the Midwest.<sup>24</sup> The purpose of these studies was to determine if there were recoverable materials in the residue being produced by facilities processing single streams recyclables. The average residual rate from these facilities was 13.5%. The majority of the residuals are screened out at various stages of the material process lines and are typically in the 2 inch minus size range. This data is summarized in Table 24 below.

Table 24: MRF Residuals Breakdown by Material and Resin

MATERIAL	COMPOSITION
PET	11%
HDPE	8%
PVC	1%
LDPE	0%
PP	6%
PS	3%
Other Plastic	12%
Paper	34%
Metals	3%
Mixed Residuals <sup>25</sup>	14%
Fines <sup>26</sup>	8%
<b>Total</b>	<b>100%</b>

These data align with what many MRFs noted during the interviews RRS conducted for the Gap Analysis. Interviewees discussed the prevalence of paper and plastics in their residue, and several stated this was due to specific types of these

<sup>24</sup> These studies were conducted on a proprietary basis and the results here are aggregated and average across the studies.

<sup>25</sup> Mixed residuals are various materials that cannot be effectively sorted by material type.

<sup>26</sup> Fines are extremely small materials, primarily glass, that is ground to a dirt like consistency.

materials not being accepted in their programs (e.g., films or polystyrene) or improper sorting in the facility. Interviewees also noted challenges for materials that could be accepted but are not properly sorted due to product design elements, such as shrink-wrap labels or multi-layer plastics.

Outside of these specific materials, several interviewees emphasized that they feel the bulk of their residue stream is truly unrecoverable because of the size or quality of the material within it. However, at the time of the interviews, none of the contacted facilities had conducted residue composition studies of their material, so this is purely anecdotal evidence. Some facilities may be interested in conducting a study in the future, but, as noted in the sections above, many feel limited in staffing and time to do so.

### EGLE'S MATERIALS OF INTEREST

To continue improving Michigan's recycling rate, EGLE acknowledges that materials that have been traditionally described as hard to capture and recycle must be considered. In previous Gap Analyses, processing deficits were highlighted for films, PP, textiles, and glass. Some improvements have been made in capturing these materials in recent years, but many challenges still remain for MRFs interested in pursuing them. During the MRF interviews, RRS asked contacts about their facility's experience with these materials, which is summarized in Table 25 and detailed further in the following sections.

Table 25: Material of Interest Accepted at Interviewed MRFs

MRF	FILMS	PP	TEXTILES	GLASS
1	✗	✓	✗	✓
2	✗	✓	✗	✓
3	✗	✓	✗	✓
4	✓	✓	✗	✗
5	✗	✓	✗	✓
6	✗	✓	✗	✓
7	✓	✓	✗	✗
8	✓	✓	✗	✓

### PLASTIC FILMS

Of the MRFs interviewed, three facilities accept film materials. The first facility utilizes a dual stream system and collects and processes about 20 tons of film per month. They accept a variety of films, including plastic bags, shrink wrap, agricultural film and wrapping. This material is collected through their dual stream program with paper boxes and bags. Currently, the facility works with Trex Decking, who incorporates their film into composite decking.

The other two facilities that accept this material utilize commercially source-separated systems of collection. They accept Grade A and Grade B LDPE from their customers, and the materials are directly bailed and shipped to market after arriving at the facility. The material is generated in relatively low quantities, so the facilities do not consistently utilize a specific end market but aim to send it to domestic markets when possible.

These MRFs are unique in their acceptance of this material because most interviewed facilities described a lack of space, equipment, and labor to capture films. Interviewees repeatedly described issues with films negatively impacting facility sorting efficiency, as well as perceived difficulties in capturing and storing enough of it to market the material in a cost-effective manner. Some noted the possibility of partnerships with end markets, such as Trex Decking, if they were to accept films in the future but were weary of the processing and selling logistics and financial feasibility of this material.



## POLYPROPYLENE

In contrast to films, all interviewed facilities accept and process PP (#5). However, in these facilities, PP is most often collected and marketed with other plastics (typically #3 - #7) in mixed bales. This method allows the MRFs to create full bales and get the materials to market faster, but mixed bales limit the potential financial return for high-value plastics like PP. Additionally, these bales are often sent to end markets outside of Michigan, such as EFS in Ontario, Canada, which is cost and labor intensive. The MRFs interviewed all understand the value of this material and expressed interest in processing and bailing PP separately if support for capital and labor needs could be provided. However, the lack of local end markets is a significant concern that will need to be addressed before most are willing to make this transition.

The commercially source-separated facilities included in the interview analysis will collect and market this material if it is generated by their customers. However, they collect a relatively small amount of the material. It should also be noted that one of the commercially source-separated facilities also acts as a residential transfer station outside of their commercial recycling operations. The residential programs that send material to this facility do accept PP, but the material is never processed on site. All residential recyclables are sent to a third-party for processing.

## TEXTILES

Of the MRFs interviewed, none accept and process textiles. Some interviewees noted separate drop-off locations provided by their organizations that accept textiles from community members. However, these programs are often operated in conjunction with donation organizations, and the material never passes through the MRFs.

Additionally, some of these drop-off programs shut down because of the COVID-19 pandemic and have not relaunched due to more pronounced limitations in the reuse market. The interviewees indicated there would need to be significant investment in processing equipment and end-markets before they consider accepting and processing textiles at their facilities. This would include addressing challenges around material quality and storage.

## GLASS

Glass is accepted and processed at all interviewed single and dual stream MRFs. Most interviewed MRFs are single stream and collect glass through their regular curbside programs. The Marquette County MRF accepts this material through their regular curbside program, but they also accept this material from drop-off sites around the County where the material is source-separated. The interviewee from this facility noted that the material from the drop-off sites is extremely clean and provides great end market value to the facility.

In contrast to Marquette and the other single stream facilities, the Emmet County MRF, utilizes dual stream collection for curbside and drop-off collection of glass. Emmet County's facility accepts glass in their mixed containers stream with steel, plastic, paper cartons and cups, and aluminum containers. The facility previously utilized hand-sorting and conveyer belts to process the material, but they lost the necessary workforce to continue this practice due to inconsistent labor availability. Currently, the facility utilizes a glass breaker and conveyer belt to sort out the material, but material quality has declined as a result of the changes in processing. Their end market, SMI in Chicago, Illinois, has implemented a tipping fee to offset the quality reduction. The facility is looking for more feasible solutions because it is expensive to transport glass from Michigan's northern Lower Peninsula to Illinois, particularly with the additional tipping fee applied to the material. However, the facility, like many of the interviewed MRFs, is limited by market availability and capital needs for additional processing equipment or staffing.

The commercially source-separated facilities included in the interview analysis do not typically accept glass from customers. According to the interviewee for these facilities, they will accept this material under very specific circumstances, but it is not common practice. Similar to PP, because one of these facilities acts as a transfer station for residential recycling programs, glass will end up on site, but it is only on site briefly before being transferred to a third-party for processing.

## ORGANICS PROCESSING

Figure 20: Map of Organics Facilities in Michigan

### ORGANICS FACILITY OVERVIEW

#### ORGANICS FACILITY THROUGHPUT

Figure 20 displays all known organics processing sites and facilities in Michigan, both EGLE-registered facilities and non-registered facilities. In 2021, facilities processing less than 200 cubic yards of material, onsite anaerobic digesters, compost that is generated and used by MSW landfills, and farms accepting up to 5,000 cubic yards of yard clippings without selling the finished product do not need to register with EGLE. Note that the revised Part 115 rules for organics processing facilities now exempt facilities processing less than 500 cubic yards of material from notifying or registering with EGLE.

Table 26 breaks down all facilities based on the material processed at the site. Many facilities have more than one classification so that the table includes double counting of facilities if the facility accepts multiple types of materials.

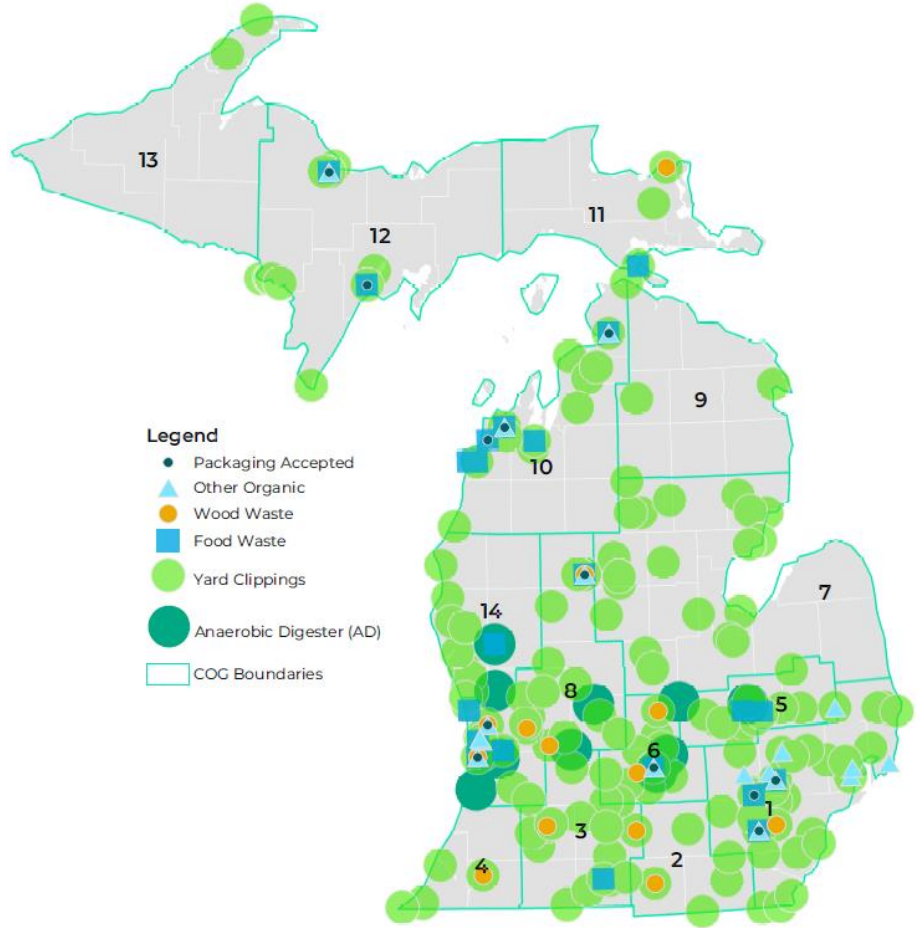


Table 26: Organics Facilities by Facility Type

MATERIALS ACCEPTED AT FACILITY	FACILITY COUNT	PERCENT OF TOTAL
Yard Clippings	163	89%
Food Waste	22	12%
Wood Waste	13	7%
Other	18	10%
Packaging	12	7%
Anaerobic Digester (AD)	10	5%

Organics processing sites not registered with EGLE, and therefore not within the EGLE WDS database, make up 32% of organics facilities (Figure 21 and Table 27).

Figure 21: Proportion of EGLE Registered Vs Non-EGLE Registered Site

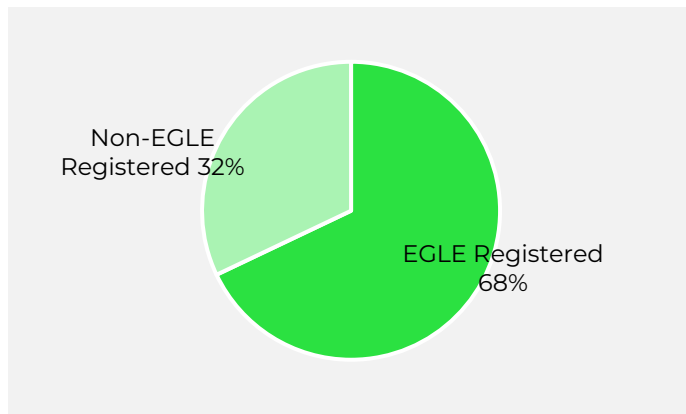


Table 27: Count of EGLE Registered Vs Non-EGLE Registered Sites

SITE TYPE	COUNT	PERCENT
EGLE Registered	125	68%
Non-EGLE Registered	59	32%
<b>Total Sites</b>	<b>184</b>	<b>100%</b>

The following section examines material throughput of compost facilities from 2019 to 2021, and the organics material targeted for recovery to meet the 45% recycling goal using the most recent data available at time of this publishing.

In 2021, 83 facilities reported bringing organic material onto site with a total approximate estimated 309,322<sup>27</sup> tons of organics processed, a 20% drop in total organics processed from 2019 (387,318 tons). From 2019 to 2021, processed yard clippings declined 24% and food waste declined by 12% while wood and other organics each increased by 76% and 90% respectively (Table 28). The drop in yard clippings and food waste from 2019 to 2021 can partly be ascribed to the closure of Spurt Industries in Zeeland Charter Township which had accepted a significant amount of both materials in 2019. The largest increase in other organics processed was due to increased manure (farm and non-farm) processing. The increase in wood waste was largely due to Morgan Composting, which processed 4,352 tons of wood waste in 2021.

Table 28: Organics Processed in Michigan in 2019 and 2021 (Tons)

YEAR	WOOD	YARD CLIPPINGS	FOOD	OTHER ORGANICS	TOTAL
2019	7,554	369,936	2,298	7,529	<b>387,318</b>
2021	13,278	279,684	2,022	14,336	<b>309,322</b>
<b>Percent Change</b>	<b>+76%</b>	<b>-24%</b>	<b>-12%</b>	<b>+90%</b>	<b>-20%</b>

While yard clippings processing dropped in 2021, yard clippings are still the predominant organic material processed in Michigan with 90% of composted organics being yard clippings<sup>27</sup>. The remaining composted material includes food (1%), other organics (5%), and wood waste (4%).

<sup>27</sup> The total organics processed in 2021 includes 2019 reported yard clippings from two facilities that are still operational but did not report in 2021.

Figure 22: Breakdown of Material Accepted at Michigan Organics Facilities

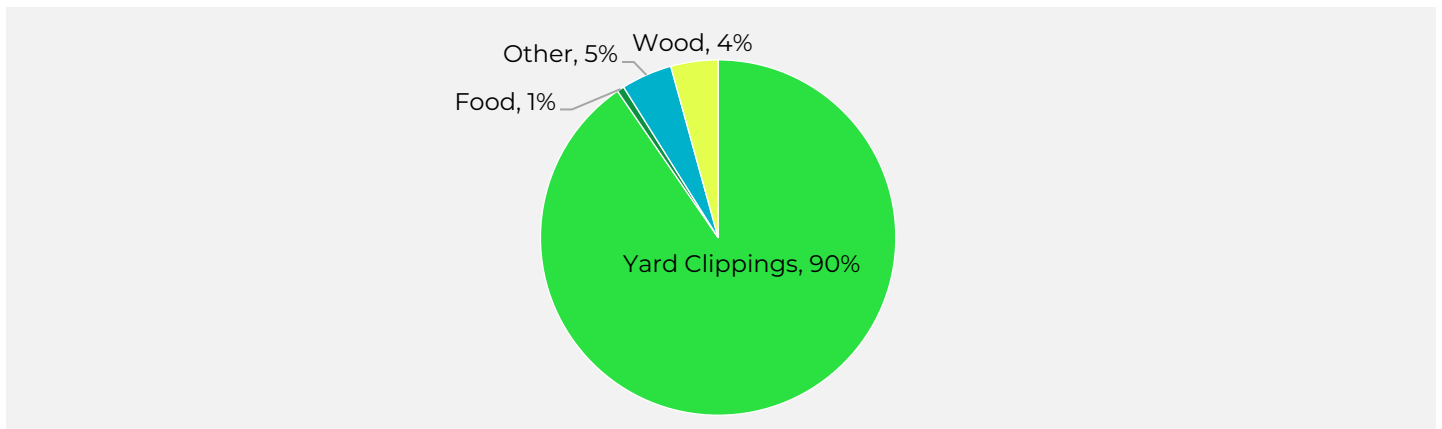


Table 29 shows the breakdown of accepted organics at Michigan compost facilities by COGs. COG 1 which includes Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne counties is the largest COG and correspondingly processes the most material at 166,936 tons or 54% of total processed organics. The second largest COG in terms of total tons organics processed is COG 8 at 56,820 tons or 18% of total processed in Michigan. COG 8 includes Allegan, Ionia, Kent, Mecosta, Montcalm, Osceola, and Ottawa.

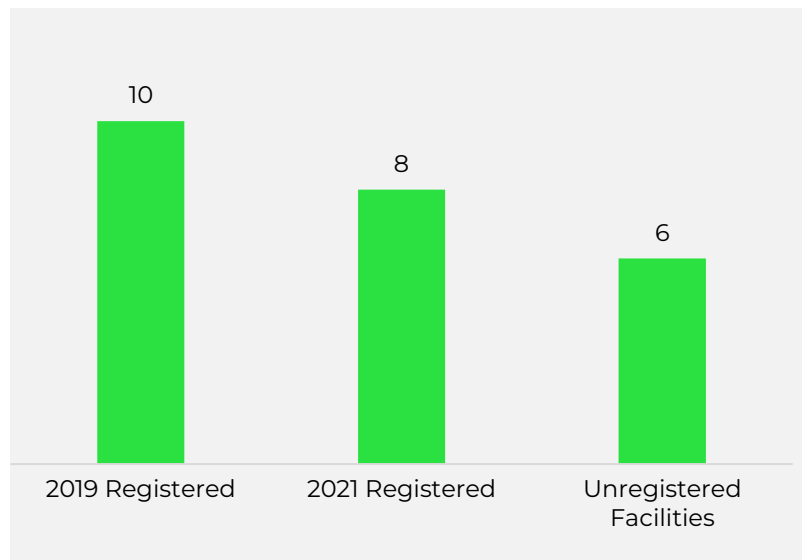
Table 29: Tons of Organics Processed at Michigan Compost Facilities in 2021 Broken Down by COG

COG	WOOD	YARD CLIPPINGS	FOOD	OTHER ORGANICS	TOTAL	PERCENT TOTAL ORGANICS PROCESSED
1	1,044	164,516	538	864	166,936	54%
2	1,980	694	0	0	2,674	1%
3	230	12,124	0	0	12,354	4%
4	342	133	0	0	475	0%
5	0	3,751	0	0	3,751	1%
6	270	16,364	338	103	19,729	6%
7	0	29,565	0	0	29,565	10%
8	9,391	35,752	1,052	10,603	56,820	18%
9	0	1,495	0	0	1,495	0%
10	0	4,301	94	90	4,485	1%
11	22	164	0	0	186	0%
12	0	4,596	0	0	4,596	1%
13	0	0	0	0	0	0%
14	0	6,230	0	0	6,230	2%
<b>Total</b>	<b>13,279</b>	<b>279,685</b>	<b>2,023</b>	<b>14,336</b>	<b>309,322</b>	<b>100%</b>

## FOOD WASTE PROCESSING FACILITIES

From 2019 to 2021, the tons of food waste brought to organics processing sites in Michigan decreased by 12% from 2,298 tons to 2,022 tons (Table 30). Over the same time period, the number of registered facilities accepting food waste also decreased from 10 to 8 (Figure 23). In addition to the eight registered organics processing facilities accepting food waste, six processing facilities in Michigan that are not registered accept food waste. Michigan and the world underwent significant changes from 2019 through 2021 due to the COVID pandemic. Recent research by ReFED found that during the pandemic, surplus food was reallocated from foodservice establishments to retail and households as restaurant activity slowed; this phenomenon may have impacted the amount of commercial food waste collected by haulers in Michigan (Hardwood et al. 2023).

Figure 23: Count of Processing Facilities Accepting Food Waste in Michigan



The NextCycle Michigan FLOWS innovation track assists compost processors and haulers, large and small, in growing their throughput and building their service offerings to collect and accept food waste. There is an opportunity for Michigan to continue to grow this sector to divert more organics from the landfill.

Table 30: Facilities Accepting Food Waste

WDS REPORT YEAR	FOOD WASTE BROUGHT TO SITE (TONS)
2019	2,298
2021	2,022

## COMPOSTABLE PACKAGING

There are 12 known facilities that accept compostable packaging (Table 31). The categories of compostable packaging reported include plastics (i.e., Polylactic Acid or PLA), paper (i.e., fiber-based), and general FSP with no data currently available of whether these are plastic products, paper-based products or both. It is also not known if the sites accept only “certified” compostable products, and which certification (i.e., BPI<sup>28</sup>, CMA<sup>29</sup>, other) is considered. Of the 12 facilities analyzed, nine accept paper, seven accept plastic, and eight accept food service packaging. Note that most facilities accept more than one category of packaging.

Table 31: Facilities Accepting Compostable Packaging

TYPE	FACILITY COUNT
Plastic, Paper, and FSP	4
Plastic and Paper	2
FSP and Paper	2
Plastic Only	1
Paper only	1
FSP only	2
Total	12

<sup>28</sup> BPI Certification, <https://bpiworld.org/>

<sup>29</sup> CMA (Compost Manufacturing Alliance) Certification, <https://compostmanufacturingalliance.com/>

## CANNABIS PLANT WASTE IN MICHIGAN

The management of cannabis plant waste has become a growing issue in Michigan since 2008 when medical marijuana use was legalized in the state with the passage of the Michigan Compassionate Care Initiative (Act 333.26424 2008). Since then, the cannabis waste issue has taken off with the full legalization of recreational marijuana in 2018 for adults over 21 (Act 333.27954 2018). The passage of recreational marijuana use in the state has resulted in an explosion of sales with \$2.3 billion in sales during 2022 and an anticipated \$3 billion in sales projected for 2023. In 2020, monthly marijuana sales in Michigan were averaging \$22 million per month, and in July of 2023, sales reached \$276 million (Burns 2023). As a result, waste, both plant material and consumer packaging, is a growing environmental challenge facing the cannabis industry. Some states are loosening their rules to allow companies to recycle packaging and compost cannabis plant debris to address this growing waste stream (Erickson 2022).

Cannabis plant waste is regulated under two different agencies in Michigan depending on the plant's THC<sup>30</sup> concentration. Marijuana, which has a THC concentration above 0.3%, and processors-handlers of hemp are regulated under the Cannabis Regulatory Agency while industrial hemp cultivation which has a THC concentration below 0.3% is regulated under the Michigan Department of Agriculture and Rural Development.

Michigan, among other states, has a mixing rule, requiring all marijuana plant waste to be mixed 50:50 with other waste rendering the marijuana debris unusable and unrecognizable before disposal in landfills or processing at compost facilities. Without mixing, marijuana waste is considered a hazardous waste stream. Additionally, each waste stream from a generating location needs to be evaluated to determine the levels of THC or other hazardous waste characterization before being disposed in a licensed landfill (Department of Environment Great Lakes and Energy 2023f). Industrialized hemp waste is not subject to the marijuana requirements and can be disposed of as solid waste unless the hemp is found to be non-compliant (THC > 0.3%) (Department of Environment Great Lakes and Energy 2020).

The current disposal regulations around marijuana are burdensome on both growers and composters. The required process not only doubles the amount of waste being transported and disposed, but if, for instance, it is mixed with yard clippings for composting, the composter may need to backhaul yard clippings to the grower, collect the marijuana plant waste, then haul it all back to the compost site for processing.

Since 2021, Colorado has made it easier for cannabis growers to compost waste plant material by updating regulations to exempt cannabis waste that is low in THC content, including stems and root balls, from the 50:50 requirement for composting. Although most states still require mixing cannabis waste with 50% non-cannabis waste, there is a current effort by composters in Michigan to follow Colorado's lead in exempting certain cannabis waste from the 50:50 requirement for composting. Kaitlyn Leffert, an environmental quality analyst for EGLE says the state is considering ways to make it easier to compost the plant material (Erickson 2022). Legislation passed in the Michigan House in 2022 aimed to reduce the burden of marijuana disposal in Michigan by eliminating the 50:50 mix requirement and allow marijuana waste to be transported and disposed of either via landfill or compost facility. The bill was sent to committee in the Michigan Senate (*Legislative Analysis House Bill 6056 and 6057 2022*).

Understanding the total volume of waste generated by the cannabis industry in Michigan is challenging. Presently, Michigan does not have waste characterization data measuring cannabis plant waste in the municipal disposal stream, and it is likely that plant waste, when mixed 50:50 with non-cannabis waste, is categorized as yard clippings or trash. The latest Michigan industrial hemp report from the Michigan Department of Agriculture and Rural Development indicates a large drop in indoor locations and cultivated acreage in 2021 and 2022 across the state, mirroring a similar drop nationwide. In 2019 for example 3,689 acres of hemp was planted in Michigan, but in 2022 that number had dropped to 225 acres (Michigan Department of Agriculture and Rural Development 2022). RRS estimates that 225 acres of planted hemp would result in approximately 680 tons of residual plant waste<sup>31</sup>. It should be noted that, hemp waste, unlike cannabis waste, is an agricultural crop residue like corn silage. Hemp is not included in reported MSW disposed, and as such, hemp should not be included in Michigan's 45% diversion rate goal.

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<sup>30</sup> THC refers to tetrahydrocannabinol and is the primary psychoactive cannabinoid extract from the cannabis plant.

<sup>31</sup> Detailed information regarding the estimation can be found in Appendix for Processing Infrastructure.

Presently, the generation of marijuana waste in Michigan cannot be estimated due to lack of data from the Cannabis Regulatory Agency regarding acres cultivated or indoor growing square footage. EGLE should consider working with the Cannabis Regulatory Agency to track metrics that can help estimate the amount of waste generated from the cannabis growing industry in Michigan.

## WOOD WASTE IN MICHIGAN

Wood waste is a diverse stream of material that includes natural wood, treated and painted wood, lumber and engineered wood, pallets and crates, and wood by-products such as sawdust. The majority of wood waste in Michigan is diverted from landfilling to markets such as mulch and wood fired power plants. However, some wood waste still ends up in the MSW disposal stream. An estimated eight to 11% of the material in the MSW stream is estimated to be wood waste accounting for approximately 733,400 tons per year.

Diverted wood waste includes industrially generated wood waste such as wood scraps, sawdust, and pallets as well as debris such as trees, leaves, and branches, from forest harvesting and tree trimming services. Wood generated in these instances is going to composters, tree-trimming grinders, and the biomass energy industry. The biomass energy industry represents the largest market for processed urban wood waste and material from logging, agriculture, and other sources of wood waste that do not traditionally landfill their waste. In the 1980s the biomass industry experienced rapid growth in Michigan, fostered by the Public Utilities Regulatory Policies Act of 1978 (PURPA), which promoted renewable energy sources. Four wood fired power plants compete for wood fuel in Northern Lower Michigan. There is an additional wood fired plant, further south, near Flint, Michigan in Genesee County. The biomass energy industry in Michigan is continuously seeking additional feedstock as the industry feedstock is limited and highly competitive and as such wood waste that is readily divertible is already being diverted.

Wood waste that ends up in the landfill primarily comes from residential and commercial construction and demolition programs and includes lumber, furniture, and wood crates and pallets (Eagle 2023). Often the wood is somewhat or slightly damaged but may still be usable. A 2010 research study on wood waste found that wood waste generated from the construction of a 2,000 square foot single-family home ranged from 1,500 to 3,700 pounds of solid-sawn lumber and 1,000 to 1,800 pounds of engineered wood products. The study found that items such as post-construction oriented strand board (OSB) could be repurposed into shelving, pallet parts, and stair treads and risers, post-construction spruce lumber waste could be repurposed into finger-jointed structural lumber and modeling, and the remaining non-usable spruce and OSB could be ground into wood mulch. Overall the study determined that 50 to 60% of the OSB waste material and 35 to 50% of the treated lumber could be recycled into useable products (Araman, Hindman, and Winn 2010).

Another source of wood waste in MSW is large tree debris and stumps from residential and commercial properties that may not fall under the yard clippings ban and are not accepted in yard clippings curbside or drop-off programs.

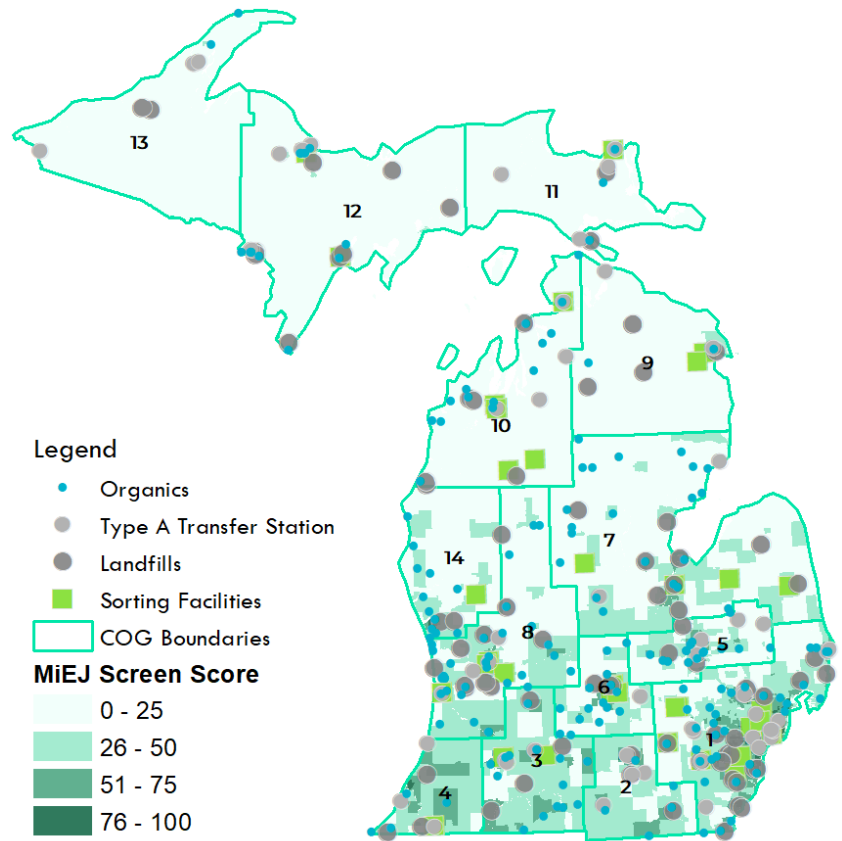
Currently it is not known what the composition breakdown of wood waste is in Michigan's MSW stream, making it challenging to understand the full diversion potential of the wood waste disposal stream. EGLE should consider targeted wood waste composition studies. Likely solutions to address wood waste in landfills in Michigan include:

- Drop-off sites that accept tree stumps and large tree debris as well as lumber, furniture, and pallets
- Partnerships with Habitat for Humanity or other similar organizations that may have an interest in post-construction material that is still usable for building
- Education and outreach campaigns with residents and businesses on ways to prevent wood waste and potential recycling solutions

## ENVIRONMENTAL JUSTICE AND INFRASTRUCTURE

Reaching 45% diversion rate will require Michigan to invest in recovery infrastructure such as MRFs, compost facilities, and development in end markets. While this infrastructure is an essential part of the materials management economy and creates job and other economic opportunities across the state, it is also critical to acknowledge the impact waste infrastructure has had on disadvantaged communities through time. Part of that acknowledgement has begun to happen through EGLE's MiEJScreen interactive mapping tool, which identifies communities that have been disproportionately impacted by environmental hazards including waste facilities. While the goal is to move away from disposal and towards lower environmental impact facilities such as MRFs, recycling infrastructure still comes with added noise, truck traffic, and in instances poor management odor. Recycling infrastructure should not simply be placed in what has been considered "lowest obstacle" communities that may have faced a disproportionate impact of environmental hazards through time. Instead, EGLE should critically evaluate the development of new infrastructure as it relates to a community's environmental justice score, and work with community members to spread the infrastructure burden and minimize its impact (Figure 25).

Figure 24: Michigan Waste Infrastructure Overlaid on MiEJScreen



## SECTION SUMMARY

### MRF PROCESSING AND RECOVERY

- MRFs processed 411,450 tons of recyclables in 2021.
- Facility space, capital for equipment, and staffing are barriers to expanding material processing
- 2 inch minus paper, glass, and plastics end up in residual streams because the material is too small to capture with existing equipment.
- Film, polypropylene, textiles, and glass remain difficult to capture and market for many MRFs.
- Facilities are expanding their use of AI technology to sort materials, which is resulting in more material capture and cleaner material streams.
- Anecdotal evidence indicates that residual rates improved among interviewed MRFs.

### ORGANICS PROCESSING AND RECOVERY

- Michigan compost facilities processed 309,322 tons of organics in 2021, a 20% decline from 2019. It is unclear if this decline represents a true decrease or lack of reporting. The vast majority of the organics processed was yard waste.
- Approximately 32% of the compost facilities analyzed in this report are not registered with EGLE.
- Eight organics processing sites in Michigan reported accepting food waste in 2021 for a total processed tons of 2,022.



- Cannabis plant waste is not well tracked in Michigan and could represent a significant portion of growing organics that must be managed. Currently regulations around the disposal of cannabis waste are burdensome for operators.
- The composition of wood waste in Michigan's disposal stream is not well known, however it is possible that a significant proportion of wood waste could be captured and diverted from the MSW stream. Michigan should consider conducting an MSW waste sort that examines the types of wood waste present.

## ENVIRONMENTAL JUSTICE

- EGLE has begun to address environmental justice disparities within Michigan communities through their MiEJScreen tool. Infrastructure developments are necessary to reach the state's circular economy goals, and a community's environmental justice score should be assessed to ensure infrastructure access and burdens are as equitable as possible throughout the state.

# END MARKETS

End markets are essential to Michigan’s recovery goals and support critical manufacturing jobs across the state. The end markets section below provides an update to the national ACR as of July 2023 and presents a map of end markets across Michigan. The section further dives into several specific commodities including plastic film, PP, textiles, and glass.

## GENERAL END MARKET UPDATES

The July 2023 single stream ACR was \$39.31 per ton (Figures 26 and 27). This is down significantly from \$104.83 per ton in July 2022. Prices for all commodities began dropping from a high of \$117.63 per ton in May of 2022 with fiber and plastics impacted most significantly (RecyclingMarkets.net 2023)). The drop is likely reflecting the volatility of the market due to impacts from the COVID-19 pandemic and fluctuating oil prices which impact virgin plastics directly. The market is likely on a path towards stabilization at a lower ACR than the highs of 2021 and 2022. Fiber and plastic prices have recovered slightly from the bottom of November 2022 through February 2023.

The decline in commodity value is impacting the bottom line of all major MRF operators in the U.S. However, the impact of lower commodity values has not been felt uniformly across the industry. WM reported that the company’s fully automated MRFs averaged 33% lower labor costs and 18% lower total operating costs per ton than the company’s MRFs that had not been upgraded. WM sees opportunity in continued investment in recycling with strong customer demand, investments in MRF sorting technology, and a shift from commodity revenue reliance to fee based service with commodity revenue sharing (Paben 2023).

Figure 25: Five Year Single Stream Average Commodity Revenue

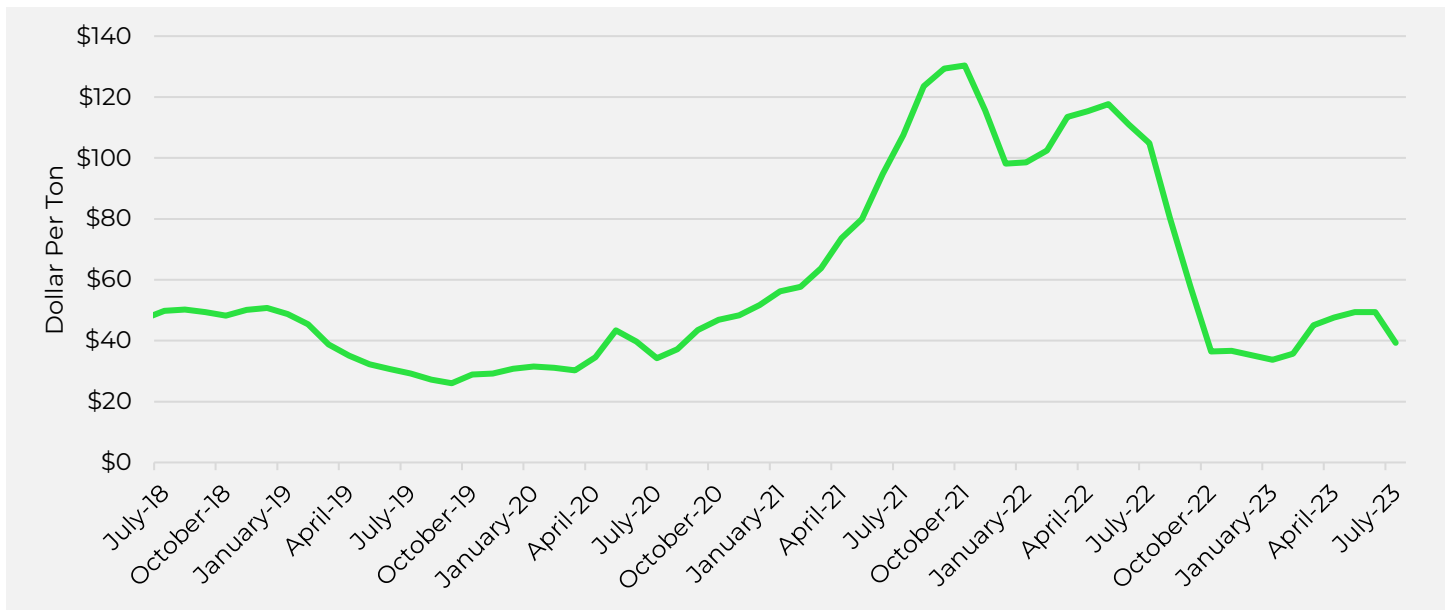


Figure 26: Five Year Single Stream Average Commodity Revenue Broken Down by Commodities<sup>32</sup>

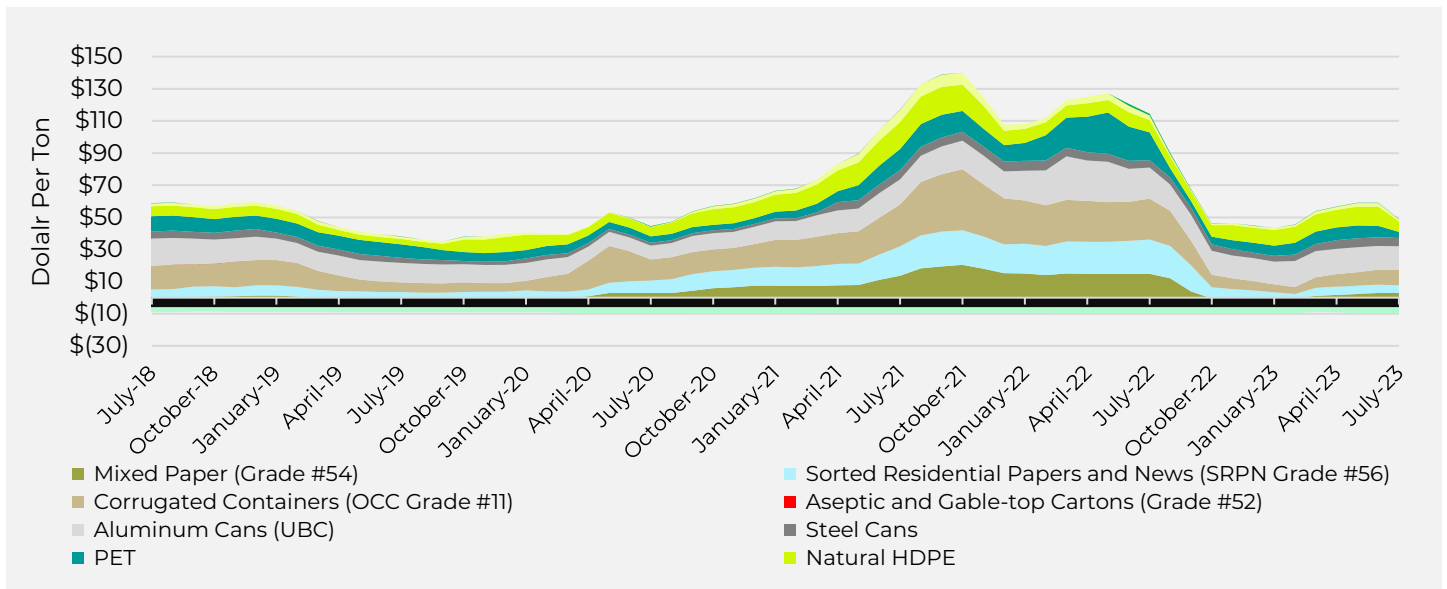
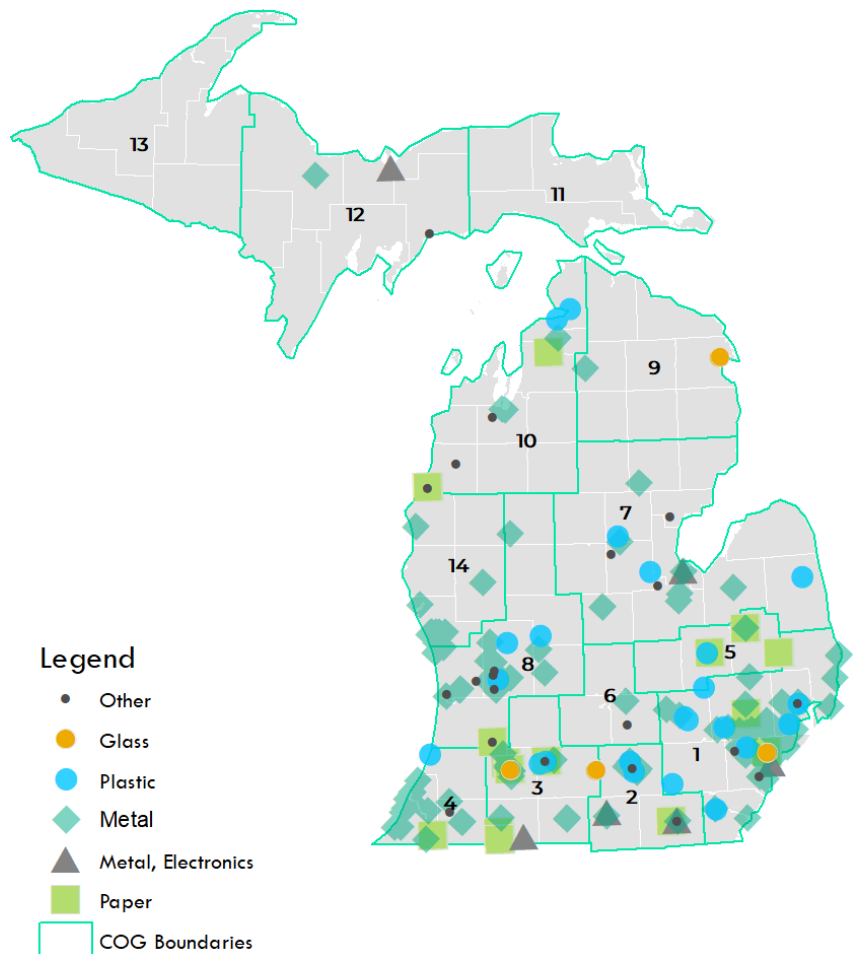


Figure 28 shows a map of all known Michigan end markets as of July 2023. It should be noted that these end markets may potentially be accepting recycled content, however it is challenging to determine exact feedstocks for each company due to the proprietary nature of the information. Some end markets shift between utilizing recycled and virgin content depending on fluctuating prices. A list of all end market companies is included in the Appendix.

Tables 32 through 41 present market behavior updates and RRS forecast and recommendations for commonly sorted and marketed commodities. Market updates for materials discussed in more detail such as PP and glass are located within those specific sections.

Figure 27: Michigan End Markets Map



<sup>32</sup> The detailed ACR includes a breakdown of commodities commonly sorted and marketed by MRFs and does not include commodity bales such as PP or bulky plastics.

Table 32: Market Behavior and Forecast for Old Corrugated Cardboard (OCC)

PAST MARKET BEHAVIOR	RRS FORECAST AND RECOMMENDATIONS
<ul style="list-style-type: none"> <li>OCC historically tracked significantly higher in price in the Great Lakes than the national average of \$49.19/ton in July 2023.</li> <li>Domestic Price OCC is influenced purely by "mill demand" not consumer demand in last 10 weeks. Dropping freight rates also helped pricing.</li> <li>"New recycled paper mills seek more OCC, hiking up prices for third straight month with stunted supplies".</li> <li>Atlantic Paper is finally open- 400,000 tons</li> <li>Cascades Bear Island, VA- 465,000 tons</li> <li>PCA, Jackson, MI &amp; Domtar, TN- 1.1 million tons</li> <li>Exception is PNW- PCA" temporary" outage 560,000 tons/year. Wallula, WA, mill left the region oversupplied despite export demand pulling more tons and NORPAC increasing capacity.</li> </ul>	<p>SHORT TERM: More Capacity, less packaging demand pull through quarter, Summer Boom, China bust</p> <ul style="list-style-type: none"> <li>Interest rates high, inflation still over 4%, China demand, world economy remains recessionary, containerboard demand &amp; durable goods demand low,</li> <li>China's faltering causing Asia pulp consumers drop in demand.</li> <li>Demand did not improve in Q2 (rush before the June swoon), which would have stabilized containerboard pricing at higher levels.</li> <li>Prices Continue dropping &gt;\$900/metric ton to &lt;\$750/ metric ton in 2023.</li> </ul> <p>LONG TERM:</p> <ul style="list-style-type: none"> <li>Price increases during COVID-19 inflationary period made other packages more attractive.</li> <li>Amazon using 35% less OCC (lighter packaging and less OCC per package)</li> <li>Economic downtime is common among packaging paper mills as demand for boxes shrinks.</li> <li>Flat prices: Export pricing dropped by \$22.70 per ton.</li> </ul>

Table 33: Market Behavior and Forecast for Sorted Residential Papers and News (SRPN)

PAST MARKET BEHAVIOR	RRS FORECAST AND RECOMMENDATIONS
<ul style="list-style-type: none"> <li>Drop of USD \$82/ton vs. one year ago. Price down 77.2% from last year to USD \$24.25/ton in July 2023.</li> <li>Differential of SRPN with mixed paper (MP) down to &lt;USD \$11/ton some places, same price as MP. Premiums still make this grade hard to track where older mills need more sorting.</li> <li>Newsprint demand down 16%.</li> <li>MP Differential to OCC historically low (\$25/ton).</li> <li>MP/SRPN Differential down to USD \$11/ton.</li> </ul>	<p>SHORT TERM:</p> <ul style="list-style-type: none"> <li>More mills close or are converted in 2023.</li> <li>China light grey pulp for away from home tissue at overcapacity long-term, over 122 tissue machines built in last three years.</li> </ul> <p>LONG TERM:</p> <ul style="list-style-type: none"> <li>Flat to slightly rising due to quality.</li> <li>SRPN pricing has separated from mixed paper with good market balance.</li> <li>True mixed old newspaper ONP (SRPN, #8 ONP)</li> <li>Keep in programs.</li> </ul>

Table 34: Market Behavior and Forecast for Mixed Paper (MP)

PAST MARKET BEHAVIOR	RRS FORECAST AND RECOMMENDATIONS
<ul style="list-style-type: none"> <li>Down 80% year-over-year but up from negative to USD \$13.32 in July 2023.</li> <li>Lower demand pull from Asian pulpers into China markets.</li> <li>Domestic demand for Mixed Paper still increasing steadily increasing due to better cleaning mills from reshoring North American capacity. Used as a hedge against OCC prices.</li> <li>Exports free alongside shipping Asia are down 24%, India remains largest buyer but vacillates on appetite for MP.</li> </ul>	<p>SHORT TERM:</p> <ul style="list-style-type: none"> <li>Contamination is still a big challenge vs. cleaner grades (OCC, SRPN).</li> <li>MP may see some modest increases through the remainder of 2023 if OCC pricing continues to improve.</li> </ul> <p>LONG TERM:</p> <ul style="list-style-type: none"> <li>Will rise and fall with North American OCC demand and China's need for pulp through Asian mills.</li> <li>Collected tons are falling from same site facilities due to selective consumption now moving away from durable goods, elimination in U.S. markets and continued digitization and growth of packaging pouches.</li> <li>Keep in programs.</li> </ul>

Table 35: Market Behavior and Forecast for PET (#1) Bottles

PAST MARKET BEHAVIOR	RRS FORECAST AND RECOMMENDATIONS
<ul style="list-style-type: none"> <li>Abundant virgin resin supplies and capacity, lower production cost.</li> <li>U.S. PET producers exported ~15M tons (29.8 million pounds) January through March; &gt;70% to North American partners.</li> <li>China nearshoring &amp; re-shoring up almost 40% vs. 2022.</li> <li>rPET flake and pellet prices dropped across North America = continued demand weakness and pressure from competitive imports</li> <li>Post-consumer MRF rPET bales are down in July 2023, dropping further from June, now USD \$0.07/lb. avg. compared with USD \$0.1289/lb.; year-over-year; a 77% drop.</li> </ul>	<p>SHORT TERM:</p> <ul style="list-style-type: none"> <li>PET markets have historically been dominated by fiber /textiles. Soft markets for end uses that traditionally use a lot of rPET (e.g., carpet) have led to a slowing of demand and lower prices for recycled PET. In the last two years packaging markets have overtaken fiber as the highest end use</li> </ul> <p>LONG TERM:</p> <ul style="list-style-type: none"> <li>High inventories and rising resin capacity in the United States and China, coupled with slower economic growth and a bad industry reputation will keep plastics pricing lower.</li> <li>China’s demand for rPET minimal with new capacity.</li> <li>Increasing divergence in cost vs. modern new virgin resin plants (11 million new tons by 2025, an increase of 25%).</li> <li>Keep in programs.</li> </ul>

Table 36: Market Behavior and Forecast for HDPE Colored Bottles and Jars (CHDPE #2)

PAST MARKET BEHAVIOR	RRS FORECAST AND RECOMMENDATIONS
<ul style="list-style-type: none"> <li>Plastic exports overall saw historic lows, down 38% in 2019 compared to previous year and 60% compared to 2017 creating an oversupply.</li> <li>MRF bales cHDPE are down in July 2023, dropping further from June now USD \$.0931/lb. avg. compared with USD \$0.1675/lb. in June 2023; year-over-year a 59% drop.</li> </ul>	<p>SHORT AND LONG TERM:</p> <ul style="list-style-type: none"> <li>cHDPE bales will continue to trade at or below zero for the next two to five years. However, plastics industry is responding through chemical recycling initiative which deconstructs polymers.</li> <li>Megatrend will grow markets for mixed plastic.</li> <li>Keep in programs. rCHDPE will eventually become more valuable for recycled content.</li> </ul>

Table 37: Market Behavior and Forecast for HDPE Natural Bottles and Jars (HDPE #2)

PAST MARKET BEHAVIOR	RRS FORECAST AND RECOMMENDATIONS
<ul style="list-style-type: none"> <li>Recovered PE divergence increases for natural HDPE (78% higher than colored HDPE), Low Virgin resin price decreases colored HDPE demand.</li> <li>nHDPE ability to re-use mechanically drives pricing higher despite issues with virgin divergence (virgin is much cheaper to convert from especially ethane crackers). Reported premiums on index pricing common due to demand for post-consumer recycled content.</li> <li>MRF bales nHDPE are down in July 2023, dropping further from June now USD \$0.4094/lb. avg. compared with USD \$0.7516/lb. in June 2023; year-over-year a 14% drop.</li> </ul>	<p>SHORT TERM:</p> <ul style="list-style-type: none"> <li>Increasingly soft oil market and distraction of CPGs (Consumer packaged goods) from sustainability issues may result in lower pricing in the coming months.</li> </ul> <p>LONG TERM:</p> <ul style="list-style-type: none"> <li>Lower consumption of consumer goods linked to economic downturn may soften demand for HDPE in packaging.</li> <li>Increase in capacity and low oil and natural gas prices will result in a glut of cheap virgin PE.</li> <li>rNHDPE continues to decouple pricing from the linkage with virgin resin markets due to consumer company commitments, recycled content certification, and policy.</li> <li>Keep in programs.</li> </ul>

Table 38: Market Behavior and Forecast for Bulky Rigid Plastics

PAST MARKET BEHAVIOR	RRS FORECAST AND RECOMMENDATIONS
<ul style="list-style-type: none"> <li>Bulky rigid plastics keep good movement and markets and diverge from other mixed bales.</li> <li>Pressure continues to increase on plastics manufacturers though there has been a noticeable pause in brand demand increasing due to low-cost virgin.</li> </ul>	<p>SHORT AND LONG TERM:</p> <ul style="list-style-type: none"> <li>Huge increases in worldwide virgin capacity - 8 billion new pounds in 2023.</li> <li>U.S. producers depend on overseas demand for 45% of HDPE in weakened world economy and overtly competitive new China capacity.</li> <li>Keep in programs.</li> </ul>

Table 39: Market Behavior and Forecast for Steel and Tin Cans

PAST MARKET BEHAVIOR	RRS FORECAST AND RECOMMENDATIONS
<ul style="list-style-type: none"> <li>Reshoring supply picks up steam and has helped scrap market.</li> <li>Declines in sheet prices have picked up steam in recent weeks as mill input cost decline and global steel prices continue to fall- impact of Chinese dud of a recovery.</li> <li>Following a run-up in price over the past few months the price of steel has seen a decline as more supply enters the market.</li> <li>As of July 2023, hot-rolled coil (HRC) prices were \$987/ton, down over \$100/ton from last month- sheet for cans.</li> </ul>	<p>SHORT TERM:</p> <ul style="list-style-type: none"> <li>Disruption to supply and demand brings market further down.</li> </ul> <p>LONG TERM:</p> <ul style="list-style-type: none"> <li>Extended recession will result in the market remaining low.</li> <li>Keep in programs. Has always been a positive market.</li> </ul>

Table 40 Market Behavior and Forecast for Aluminum Cans (UBC)

PAST MARKET BEHAVIOR	RRS FORECAST AND RECOMMENDATIONS
<ul style="list-style-type: none"> <li>Price generally maintains 25-35% differential from P1020 in North America which is 10-20% more than London Metal Exchange (LME) Index.</li> <li>North American recycled aluminum exports are down 10.6% to USD \$1.26 billion</li> <li>LME and New York Mercantile Exchange (COMEX) aluminum (AL) prices to fall as supply recovers (China and Russia) amid weak demand in advanced economies and China.</li> <li>Weaker-than-expected recovery in China's real estate sector &amp; supply disruptions are significant downside risks to the price.</li> <li>LME predicts worldwide flatness for AL UBC at USD \$1,598/metric ton over the next 18 months, predicts grade is close to the bottom of range at current levels USD \$1722/short ton (July 2023).</li> <li>Recycled can sheet production remains significantly higher than pre-COVID.</li> </ul>	<p>SHORT TERM:</p> <ul style="list-style-type: none"> <li>As prices fall consuming mills rejection policies on contamination and moisture increase to ensure lowest level in inventory evaluation.</li> </ul> <p>LONG TERM:</p> <ul style="list-style-type: none"> <li>Though aluminum cans have a home both for going back to can sheet or secondary aluminum, pricing will remain low.</li> <li>Beer sales in U.S. and Canada have been down since Q3 2022, hence less need for cans. Canada has reported all time low per person consumption of beer during quarter. Higher beer prices per 6/8/12-pack.</li> <li>Keep in programs; continues at positive value.</li> </ul>

Table 41: Market Behavior and Forecast for Aseptics and Cartons (Grade 52)

PAST MARKET BEHAVIOR	RRS FORECAST AND RECOMMENDATIONS
<ul style="list-style-type: none"> <li>• Consumption and recycling of cartons has shown growth, but volumes are still low (~0.5% by volume).</li> <li>• Limited MRFs sort as a separate grade and many incorporated into Mixed Paper bales.</li> </ul>	<p>SHORT TERM:</p> <ul style="list-style-type: none"> <li>• Cartons will have good pricing in the near term due to supply shortage of SOP paired with extremely high tissue demand, especially since the base of aseptics/cartons is long-strand, high quality white sulfate.</li> </ul> <p>LONG TERM:</p> <ul style="list-style-type: none"> <li>• Cartons have maintained a positive value since the grade was tracked. Markets in the Great Lakes are likely to improve as supply for sorted grades of material increases.</li> <li>• Keep in programs with dwindling long-term supply problem of sorted office paper (SOP) and sorted white ledger (SWL).</li> </ul>

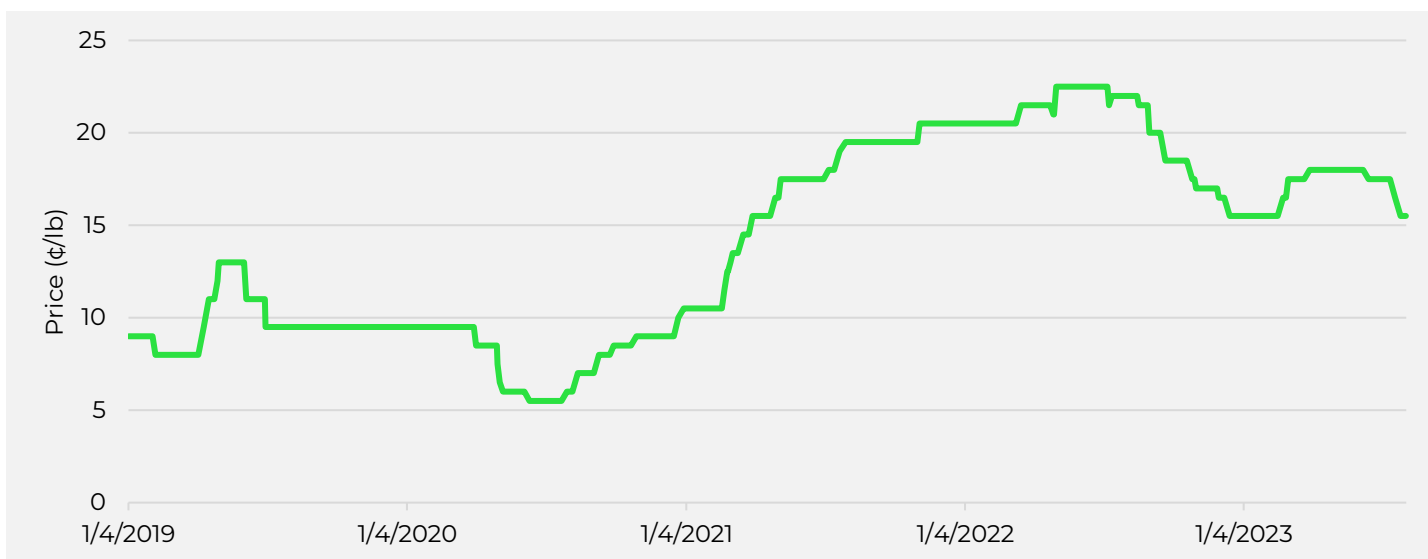
## PLASTIC FILM END MARKETS

### COMMODITY BACKGROUND AND PRICING

In 2021, 1.1 billion pounds of film was collected for recycling in the U.S. Of that film, 439 million pounds (40%) was commercially sourced PE clear film marketed as plastic film Grade A (“U.S. Sourced Post-Consumer Plastic Pounds Recovered for Recycling in 2021” 2021). The plastic films that comprise Grade A bales include shrink wrap, shipping film, pallet wrap, furniture wrap, polybags, industrial films, and manufacturing trimmings, and must be 95% clear film.

Grade A bales are the highest quality of the plastic film bales and are in high demand for postconsumer film pellets and film-to-film reclamation. Figure 28 shows the historical pricing of Grade A film in cents per pound from 2019 through 2023. In the past several years, growing post-consumer recycled content commitments by brands have pushed up demand for Grade A bales such that the market is supply constrained. This material does not pass through MRFs but rather is procured by reclaimers directly from commercial outlets or brokers generally with long-term agreements in place.

Figure 28: Historic Pricing of Plastic Film Grade A for the Midwest Region<sup>33</sup>

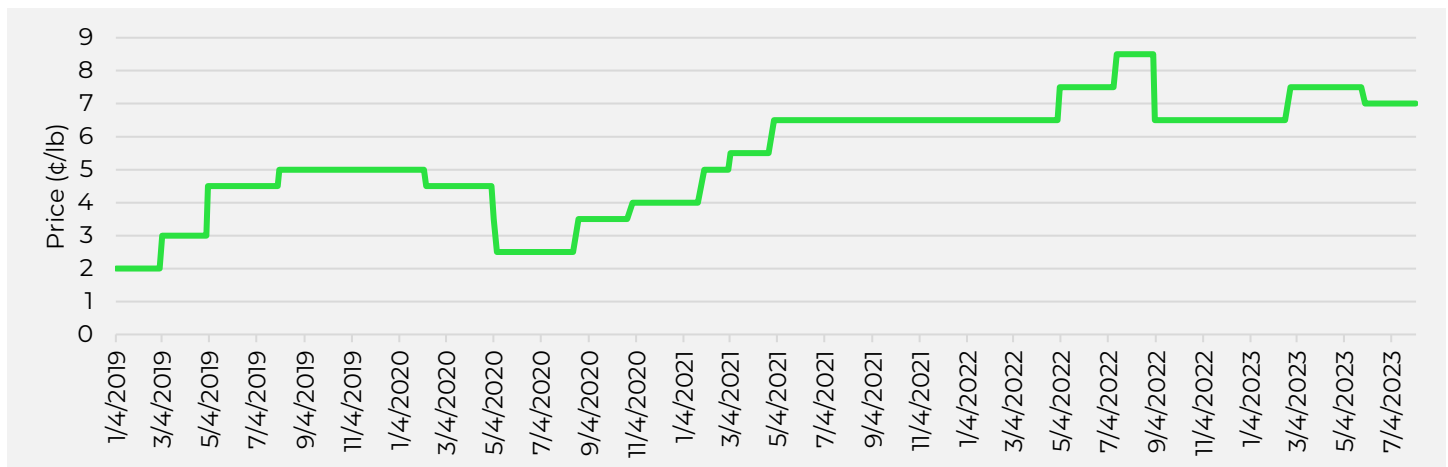


<sup>33</sup> Figures 29-37. The Midwest pricing region includes Michigan, Ohio, Indiana, Illinois, Missouri, Iowa, Minnesota, Nebraska, South Dakota, North Dakota, Wyoming, Montana, and the Canadian Provinces of Alberta, Saskatchewan, and Manitoba. All pricing data is from RecyclingMarkets.net (2023).

In 2021 approximately 264 million pounds (24%) of recovered film was PE retail and bag film while 189 million pounds (17%) was commercially sourced PE mixed color film (“U.S. Sourced Post-Consumer Plastic Pounds Recovered for Recycling in 2021” 2021). Both of these categories are traditionally traded as Grade B film bales. Grade B film is sourced from retail drop-off programs for bags and packaging which is then often mixed with commercial Grade A film and consists of 80% clear and up to 20% color film.

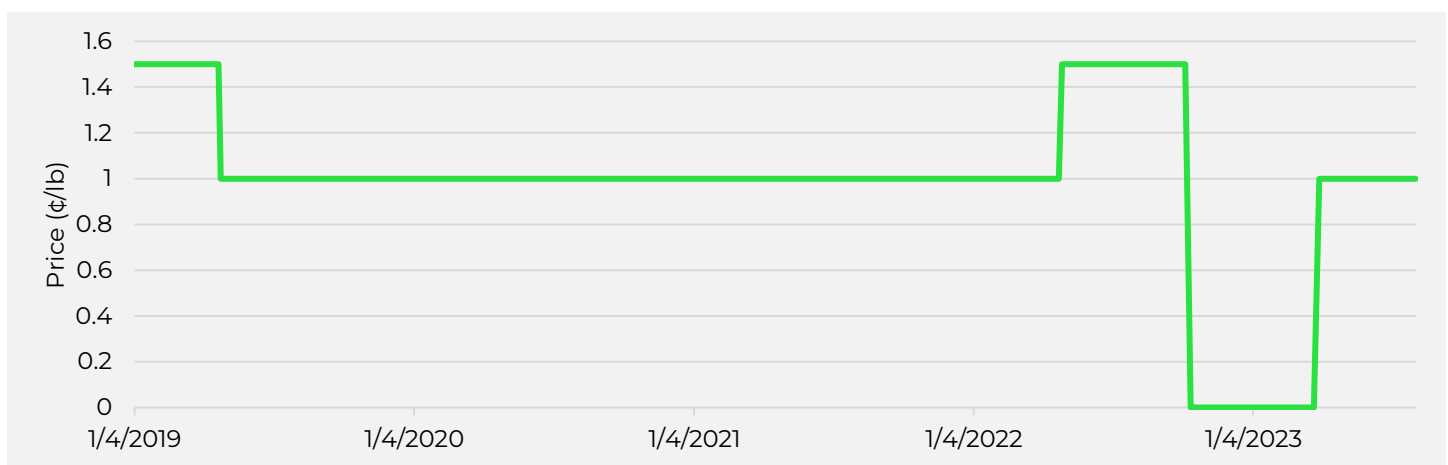
There are fairly consistent end markets for Grade B bales across the U.S. with bales purchased by film reclaimers and companies like Trex, a major manufacturer of composite decking from plastic film and major end market for Grade B bales. Manufacturers like Trex are procuring Grade B film from large generators directly so that similarly to Grade A film this material is generally not passing through MRFs. An exception may be that less-than-truckload generators use brokers to sell material or send Grade B film to commercial MRFs for processing. Figure 30 shows the historical pricing of Grade B film bales in cents per pound from 2019 through 2023.

Figure 29: Historic Pricing of Plastic Film Plastic Film Grade B for the Midwest Region



Grade C film consists of 50% clear and 50% color PE films and can be sourced from either post-consumer or post-commercial material, or both. Bales can be extremely homogenous with sourcing from boat wrap, or bales can be diverse and contaminated with sourcing from MRFs. Grade C bales also come from some agricultural sources which vary from clean and homogenous to highly contaminated. Demand for Grade C bales is coming from chemical conversion technology such as commercial pyrolysis and agricultural film recyclers, and the market for this material is highly regionally variable. If passing through MRFs, this material is likely sourced from commercial generators and mixed with materials such as cardboard. Figure 31 shows the historical pricing of Grade C film in cents per pound from 2019 through 2023. This is still a developing end market and pricing over the last year has been volatile.

Figure 30: Historic Pricing of Plastic Film Plastic Film Grade C for the Midwest Region





To support collection efforts for marina and agricultural or greenhouse films, the Michigan Recycling Coalition (MRC) has partnered with EGLE to organize recycling programs for HDPE and LDPE films generated by these sectors. The programs are intended to benefit farmers, gardeners, and boaters while preventing mass amounts of film from entering Michigan landfills.

For marina films, specifically boat wrap covers, MRC and EGLE partnered with Dr. Shrink, an international shrink wrap supplier, to create the Recycling Run program. The program has been operating for over ten years, and, according to MRC, it captured 40 tons of film in 2022 for domestic manufacturing end-markets.<sup>34</sup> To participate in the boat wrap recycling program, generators must register with MRC and purchase specific bags from Dr. Shrink for collection. Registration for the program typically closes in June, and the program runs through the proceeding summer months. Larger generators may qualify for direct material pickup. Smaller generators may drop off their boat wrap bags at a variety of sites throughout the state. Drop-off sites for the 2023 marina films program can be found in Appendix for End Markets Table 64.

MRC and EGLE have also partnered with Michigan recyclers to collect agricultural and greenhouse films, including grain bags, bunker covers, greenhouse films, drip tapes, clear stretch wraps, container liners, pallet covers, mulch film, and pond liners. These materials are collected through drop-off sites throughout the state year-round, and they must be clean and free of any accessories to be accepted.

End markets are generally not established for non-PE films and multi-layer plastic films<sup>35</sup> which is estimated to represent 44% of total film generated (RSE USA Sustainable Product Solutions 2022). Capturing and recovering these films is a focus of some chemical conversion technologies. Chemical conversion technologies are attracting substantial investment and are currently experiencing increased attention as brands and petrochemical companies aim to create circular plastic solutions for plastics that are hard to recycle due to either technological or economic constraints. Some technologies target a specific resin while others process mixed plastics. Chemical conversion offers an opportunity to upgrade low value plastics to food grade resins and have the potential to drive demand for comprehensive plastic collection and investments in plastic recovery facilities that operate like MRFs but focus on plastics only. There is industry support to increased recovery of all plastics through the Circular Plastics Fund supported by Closed Loop Partners. While there is significant announced investment, there are few commercial operations in the U.S. with only one Midwestern operation accepting plastic film.

## RELEVANT REGIONAL END MARKET UPDATES<sup>36</sup>

### MECHANICAL RECYCLING

**Novolex, Connersville, IN:** NOVA Chemicals Corporation is constructing a mechanical plastics recycling facility in Connersville, IN with the goal of operating at commercial scale as early as 2025 and sending post-consumer recycled PE to market by 2026. The driving force behind constructing this facility is to help NOVA Chemicals achieve their 2030 recycled content goal of 30%. The facility is expected to process over 100 million pounds of recycled PE (*Press Release* 2023).

**Azek, Chicago, IL:** In 2020 Azek acquired Return Polymers a polyvinyl chloride (PVC) recycler based in Ashland, OH (“The AZEK Company Acquires Return Polymers” 2020). In 2023 the Ohio facility completed a three-year expansion project that added new grinder rooms and additional warehousing for incoming and outgoing shipments. Return Polymers accepts rigid PVC, cellular PVC, chlorinated PVC, acrylics, Kydex-brand material and acrylonitrile styrene acrylate from MRFs and manufacturers and the recovered material is used in Azek’s decking, trim, and sheeting products (Kavanaugh 2023). While this expansion is not directly related to films, Azek is a major end market for PE films that are manufactured into their trademark TimberTech deck boards at their Wilmington, OH facility.

<sup>34</sup> <https://michiganrecycles.org/film-plastics/>

<sup>35</sup> Examples of multi-layer plastic films include chip bags, bar wrap, and juice pouches.

<sup>36</sup> All end market updates in this report represent end market developments that have occurred in the past two years.

## CHEMICAL CONVERSION TECHNOLOGIES

**Brightmark, Ashley, IN:** Brightmark constructed a \$260 million pyrolysis facility in Ashley, IN with the goal of processing 400,000 tons of post-consumer mixed plastics including film annually by 2023 (Staub 2020). However the facility has faced setbacks including several fires at the plant that have delayed commercial operations (Bruggers 2023). It is not clear currently when the facility will be fully operational or economically viable.

**Alterra Energy, Akron, OH:** Alterra Energy uses thermal liquefaction technology to recover 45 million pounds of mixed waste plastic annually, producing 100,000 barrels of synthetic crude oil that is sold to petrochemical firms and used as feedstock for new plastic resins and chemicals. The facility accepts all plastics except PET and PVC and primarily sources from regional MRFs. Alterra has expanded in the past two years and anticipates adding 50 additional employees by the end of 2023 (Esposito 2022).

## RELEVANT MICHIGAN END MARKET UPDATES

### MECHANICAL RECYCLING

**ACI Plastics, Flint, MI:** ACI plastics recently invested \$10 million renovating and adding a film processing line to their Flint, Michigan facility. The new plastic film line includes a shredder, Lindner wash line, Erema twin-screw extruder and water treatment system. The facility now has a capacity to process 24 million pounds of post-consumer film annually making it the largest plastic film recycling processor in Michigan. The recycled plastic pellets produced at this facility will be shipped across the U.S. and consumed in Michigan by the automotive industry, Petoskey Plastics, and Cascade Cart Solutions. The project was partly funded through a \$300,000 Renew Michigan infrastructure grant from EGLE and a \$150,000 Business Development Program performance based grant from the Michigan Economic Development Corporation (McNees 2023).

**Petoskey Plastics, Petoskey, MI:** Petoskey Plastics has recently partnered with NextCycle Michigan to investigate the establishment of plastic PE film collection points across Michigan to increase film collection. Currently Petoskey Plastics recycles 30 million pounds of PE film through their closed loop recycling programs and turns the recovered plastic into Green PE film that contains 70% recycled content (Petoskey Plastics 2020).

## POLYPROPYLENE END MARKETS

### COMMODITY BACKGROUND AND PRICING

PP recovery lags behind other commonly recovered plastics such as PET and HDPE, with only a 9% recovery rate for PP compared to 29% and 27% recovery rate for PET bottles and natural HDPE, respectively (“U.S. Sourced Post-Consumer Plastic Pounds Recovered for Recycling in 2021” 2021). One challenge to recovering PP is the diversity of packaging size, form, and applications which impacts MRFs ability to consistently sort the material. Prior to China’s implementation of National Sword, PP recovery relied on sorting into mixed plastics bales and export markets, and as a result PP reclamation was under-developed in North America compared to PET and HDPE. When export markets were no longer an option for PP recovery, many programs responded by removing PP from the accepted material list. In Michigan, only 30% of residents with curbside recycling access can put PP in their curbside bin or cart<sup>37</sup>.

While PP recovery has struggled, recent changes in technology and investment aim to increase PP capture rates. Advancements in sorting technologies including optical sorters, AI, and robotic sorting equipment are addressing challenges in sorting the varied sizes and forms of PP containers, allowing MRFs to transition from mixed plastic bales to PP specific bales that have significantly higher market value. In 2020, The Recycling Partnership launched the PP Recycling Coalition and has since, through support of PP sorting equipment at MRFs and community recycling education program, facilitated the recovery of an additional 42 million pounds of PP in the U.S. (The Recycling Partnership 2023).

PP end markets include the automotive industry and durable goods such as crates and housewares. Demand is growing for food-grade recycled PP and reclaimers are investing in capacity to produce food-grade recycled PP pellets and applying and filing for food-grade approval through the Food and Drug Administration (FDA). While capacity for food-

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<sup>37</sup> 2020 through 2023 collected data from the Michigan Materials Management Infrastructure and Programs Project also referred to as the “Mega Data” Project

grade PP has increased, most applications are not direct food contact and include beauty and pharmaceutical applications. The largest U.S. reclaimer of PP remains KW Plastics headquartered in Troy, Alabama.

Figures 32 and 33 present the historic pricing in cents per pound from 2019 through 2023 for PP and mixed plastic bales respectively. PP bales have significantly more value at 5.5 cents per pound compared to mixed plastic bales at only 1.1 cents per pound as of July 2023.

Figure 31: Historic Pricing of Post-Consumer PP for the Midwest Region

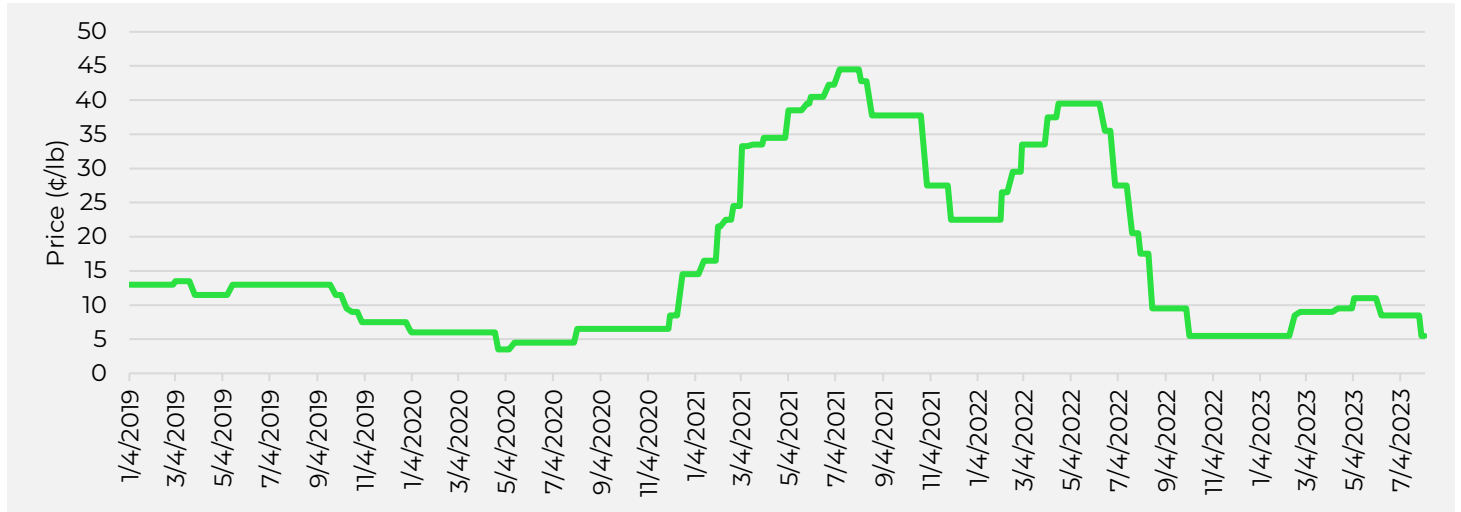
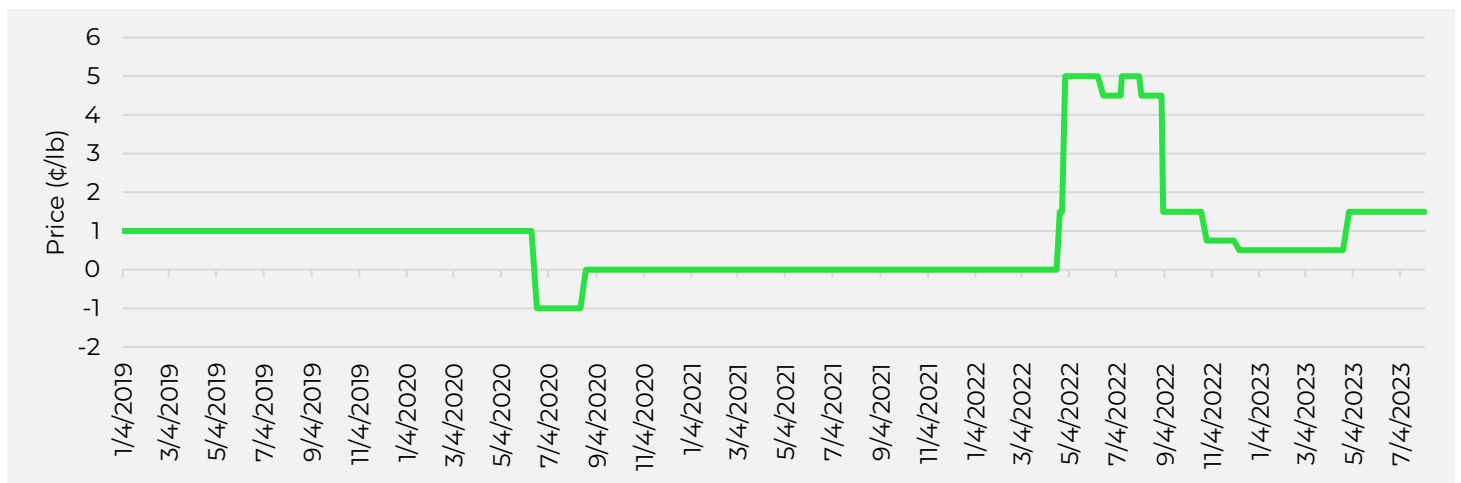


Figure 32: Historic Pricing of Post-Consumer PP for the Midwest Region



Tables 42 and 43 present market behavior and forecasts for PP and mixed plastics.

Table 42 Market Behavior and Forecast for PP

PAST MARKET BEHAVIOR	RRS FORECAST AND RECOMMENDATIONS
<ul style="list-style-type: none"> <li>The national average price for PP dropped 26% from June to July 2023. This grade is now trading at \$.0756/lb. compared to \$.1025/lb. last month, 22% drop. Down 82% from 2021 COVID high.</li> <li>3 million tons of new capacity and propane-generated propylene drop in production costs in N. America.</li> </ul>	<p>SHORT AND LONG TERM:</p> <ul style="list-style-type: none"> <li>Huge long-term rush to recycle PP by the big polyolefin producers (Exxon, LyondellBasell, etc.).</li> <li>New virgin PP capacity and low oil / natural gas markets will keep PP #5 bale pricing low for next 1-3 years.</li> <li>Keep in programs.</li> </ul>

Table 43: Market Behavior and Forecast for Mixed Plastics #3 through #7

PAST MARKET BEHAVIOR	RRS FORECAST AND RECOMMENDATIONS
<ul style="list-style-type: none"> <li>National average pricing for mixed plastics #3-7 was \$0.0072/lb. in July 2023, down from \$0.038 /lb. in July 2022.</li> <li>Movement is still steady. Some programs with high commodity risk have started to remove this grade in SE U.S. and elsewhere due to the dramatic fluctuation in price.</li> <li>#3-7 content of PP decreasing due to MRF retrofits to capture PP bales.</li> </ul>	<p>SHORT AND LONG TERM:</p> <ul style="list-style-type: none"> <li>#3-#7 bales will continue to trade at or below zero for the next 2-5 years. Fundamentals very poor short term.</li> <li>#3-7 content of PP decreasing due to MRF retrofits and program restrictions returning with low commodity prices in the U.S.</li> <li>Removal from #3-7 into sorted PP at MRFs makes remaining plastics less valuable.</li> <li>Announcements by LyondellBasell and Exxon for monomer cracker development of all plastics except Polyvinyl Chloride (PVC). Ability to handle paper not far behind.</li> <li>Most older MRFs still sell this grade.</li> </ul>

## RELEVANT REGIONAL END MARKET UPDATES

### CHEMICAL CONVERSION TECHNOLOGIES

*PureCycle, Ironton, OH:* PureCycle announced in June 2023 that they had produced the first batch of ultra-pure recycled resin from post-industrial PP at its facility in Ironton, Ohio. This was a big milestone for the facility that has faced several setbacks in the construction phase. Once fully operational the facility is expected to have a production capacity of 107 million pounds of ultra-pure recycled resin annually which is touted to essentially function like virgin resin. The technology is described as solvent-based extraction and targets PP in various forms and can tolerate a range of contaminants (Smalley 2023a).

### TEXTILES END MARKETS

Textile recovery, while historically low, is a growing commodity market. By 2032, the textile recycling market is anticipated to be valued at \$12.8 billion (*GlobalNewswire* 2023). The secondhand apparel market is also growing, with estimates putting its value around \$350 billion in 2023 ("ThredUp Resale Report 2023" 2023). These increases can in part be attributed to the fast-growing nature of textile waste, which is currently outpacing most other categories of waste. According to the U.S. Environmental Protection Agency (EPA), in 2018 only 2.5 million tons out of 17 million tons generated textiles were recovered, leaving a large margin for growth in the diversion of textile waste (U.S. Environmental Protection Agency 2018).

End markets for recovered textiles are widespread. Material brought to and resold at thrift stores such as Savers or Goodwill account for 20% of textile recovery. Remaining textiles collected at thrift stores but not sold, through donation bins, through curbside collection, or through other methods are processed by sorter-graders, who prepare and grade used clothing based on quality, condition, format, and type. Based on these grades, material is separated to be sold to either reuse or recycling markets. Textiles resold or reused outside of thrift stores account for 45% of textile recovery. Other options include industrial rag (30% of recovery) and shoddy or stuffing (20% of recovery). Approximately 5% of textiles recycled end up as waste due to contamination (Adler 2020).

## RELEVANT MICHIGAN END MARKET UPDATES

*Industrial Sewing and Innovation Center (ISAIC), Detroit, MI:* ISAIC's goal is to find sustainable solutions to fast fashion, the over production of low-quality apparel. In 2022 ISAIC received a \$259,000 grant from the Michigan Economic Development Corporation that allowed ISAIC to add 74 additional jobs to meet increasing demands from existing clients, including Carhartt (Arshad 2022). ISAIC has also received a \$166,000 grant from EGLE to develop a scalable model to upcycle textile scraps into home goods with needle felting, otherwise known as pin felting.

*NexTiles, Detroit, MI:* NexTiles manufactures eco-friendly building insulation from recycled automotive manufacturing waste and won the 2021 RIT Showcase Judges' Award and People's Choice. Additionally, NexTiles won a \$16,000 prize in NextCycle's March 2022 pitch competition and the event's People's Choice Award. The company also received a NextCycle MICROS grant ("Nextiles" 2021).

*Goodwill Association of Michigan:* Goodwill Association of Michigan is working to raise funds through both public and private financing to build a post-consumer textile recycling hub system throughout Michigan. Goodwill envisions partnering with Michigan universities to develop the business plan and advanced sorting technology, ultimately creating a replicable hub model with 40 million pounds of annual capacity (Goodwill Association of Michigan 2023).

## GLASS END MARKETS

### COMMODITY BACKGROUND AND PRICING

Glass is a steady commodity market in the U.S., with pricing for different forms of glass remaining stable over time. In general, pricing for glass depends on levels of contamination in the collected product. Common contaminants include fines, dirt, shredded paper, bottle caps, and corks. Prices for collected glass vary between negative values of -\$25 per ton (Figure 12) for very contaminated glass to nearly \$60 per ton for clean, flint glass (Figure 9). Since source-separated glass is typically more valuable, most glass collected either curbside or commercially requires cleaning and color sorting before it becomes usable by manufacturers. MRFs are increasingly investing in equipment, including air separators, vacuum systems, and lights removal equipment, to produce a cleaner glass product that is desirable to end markets.

While many recyclables rely on export markets, the end markets for recycled glass are primarily domestic. Recycling glass containers helps North American glass container and fiberglass manufacturing plants remain competitive and protects North American jobs. Additionally, there is almost always demand from container and fiberglass manufacturers for additional, consistent access to clean recycled glass, also referred to as cullet.

Whereas most end markets melt glass in furnaces to create new products, alternative non-furnace end markets, while utilizing a smaller amount of recycled glass, are becoming increasingly popular. A new and growing promising market for recycled glass is ground glass pozzolan, which is used in concrete production as a supplementary cementitious material, replacing fly ash and slag with a much more environmentally beneficial material. Other end markets include countertops made from recycled glass, tableware, and art pieces.

In the Midwest, glass markets are strong, with several container and fiberglass manufacturing plants located in southern Michigan, Wisconsin, Indiana, and Ohio. Beneficiation, or glass cleaning, capacity remains high, with several facilities in these states feeding container and fiberglass plants. However, the glass market is weaker in Northern Michigan, where plants cannot move glass to market as easily. This is due to the longer transportation distance to the existing markets in the Midwest. The region could benefit from regionally aggregating clean glass and shipping it by rail to a market in the Midwest, but it would likely need to offset transportation costs through grants or other funding mechanisms.

Figures 33 through 36 show the historic regional pricing from 2019 through 2023 of flint, green, amber, and mixed glass respectively in dollars per ton. Color sorted glass has maintained strong value over the past four years while mixed glass continues to be a significant cost to MRFs.

Figure 33: Historic Pricing of Flint Glass for the Midwest Region



Figure 34: Historic Pricing of Green Glass for the Midwest Region

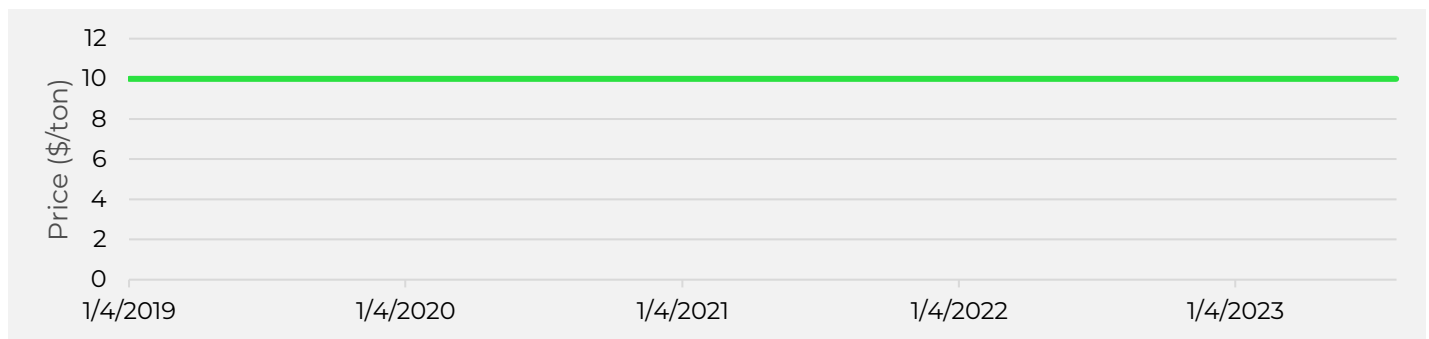


Figure 35: Historic Pricing of Amber Glass for the Midwest Region

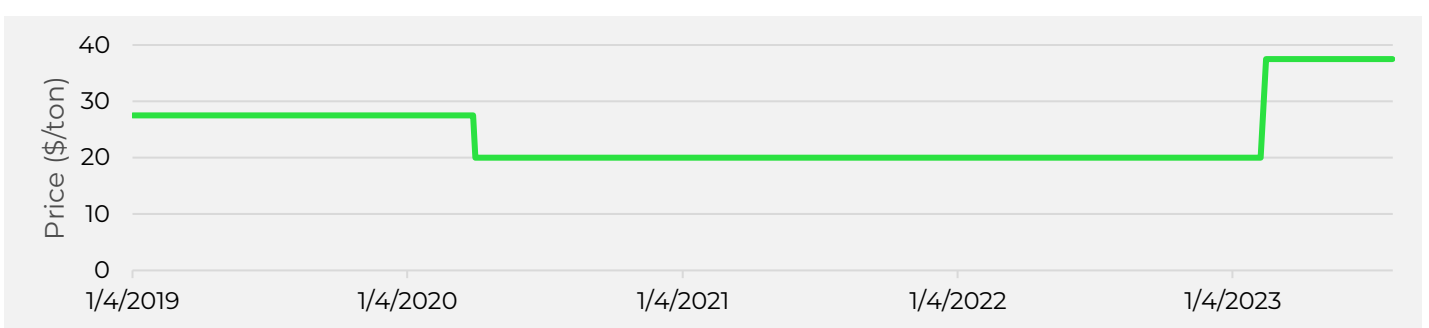
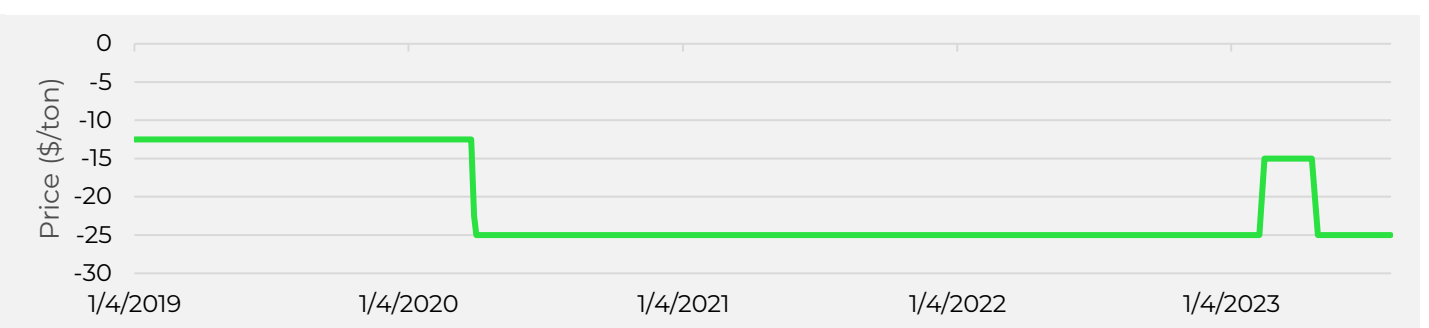


Figure 36: Historic Pricing of Glass Three Mix for the Midwest Region



## RELEVANT REGIONAL END MARKET UPDATES

*Rumpke, Bloomington, IN:* In May 2023, Rumpke opened a resource recovery transfer facility accepting waste and recycling from residential and commercial generators. Recyclables will be sent either directly to end markets in the case of commercially sourced clean corrugated cardboard, paper, or other source-separated commodities or sent to Rumpke’s Cincinnati MRF for further processing in the case of mixed residential or commercial recyclables. Additionally, the facility has a separate glass bunker for glass collection. Glass will be sent to Rumpke’s Dayton glass facility for further processing or directly to end markets if it is clean enough (Smalley 2023b).

## RELEVANT MICHIGAN END MARKET UPDATES

*Knauf Insulation, Albion, MI:* Production volumes at Knauf Insulation increased by more than 30% with a multi-million dollar investment into an idle production line. The increased production was projected to add 34 new full-time positions at the facility and generate over 85 million pounds of loose-fill insulation per year (“Knauf Insulation Increases Production with Expansion in Albion, Michigan” 2021).

*Lafarge, Alpena, MI:* Alpena County and the newly formed Northeast Michigan Materials Management Authority has partnered with Lafarge in Alpena to take glass from a newly formed recycling program. Lafarge will crush the glass and mix it into their cement product as an alternative to sand (Shulwitz 2023).

*Marquette County, MI:* 1,000 tons of glass has been kept out of landfills over the past two years with the Marquette County recycling drop-off program. The glass is pulverized into sand and used as a material mix for road building or sand traction in the winter. The Upper Peninsula of Michigan is too far from commercial recycling markets for glass so that glass pulverization is currently the only viable option to keep glass out of disposal (McWhirter 2023).

Table 44 presents market behavior and forecasts for mixed glass.

Table 44: Market Behavior and Forecast for Mixed Glass

PAST MARKET BEHAVIOR	RRS FORECAST AND RECOMMENDATIONS
<ul style="list-style-type: none"> <li>• Shown as a cost of \$24.69/ton in July 2023.</li> <li>• MRF quality of recovered glass had been a significant issue.</li> <li>• Glass container market was losing share to other types of packaging or use of virgin alternatives.</li> </ul>	<p>SHORT AND LONG TERM:</p> <ul style="list-style-type: none"> <li>• 3-mix glass will continue to trade low and may decrease further, as fiberglass for construction slows with the economy, and glass packaging continues to decline.</li> <li>• However, glass is popular to recycle, and the public expects to have convenient access.</li> <li>• Keep in programs but evaluate if markets disappear completely.</li> </ul>

## SECTION SUMMARY

### GENERAL END MARKETS

- The average commodity revenue (ACR) in July 2023 was \$39.31 per ton, a 167% drop in commodity prices since July 2022. Commodity pricing is likely on a path towards stabilization at a lower ACR than the highs seen in 2021 and 2022.
- Material recovery facilities are guarding against commodity swings through automation that is reducing operating costs and shifting from reliance on commodity revenues to a fee based structure and commodity revenue sharing with contracted communities.

### PLASTIC FILM

- 1.1 billion pounds of plastic film was recovered in the U.S. in 2021. Approximately 57% of this recovered film is commercially sourced polyethylene film and 24% is PE film sourced from a combination of commercial

generators and residential retail take-back programs<sup>38</sup>. Specific Michigan PE film recovery rates are not available.

- Michigan has added PE film mechanical recycling capacity through the addition of a plastic film sorting line at ACI plastics in Flint, MI.
- Advanced recycling technologies may offer solutions for hard to recover film such as multi-layer packaging and non-PE films, but scaling these facilities has been challenging. At present there are no commercially scaled end markets for these materials.

## POLYPROPYLENE

- National recovery rates for PP remains low at 10% after export markets evaporated. There are no Michigan specific recovery rates.
- Approximately 30% of Michigan residents with access to curbside recycling can put PP in their curbside cart or bin.
- Investment into PP capture rates have led to advancements in sorting technology. Equipment such as optical sorters, artificial intelligence, and robotic sorters are allowing MRFs to move away from low-value mixed plastic bales to more valuable PP bales.
- Groups such as The Recycling Partnership are investing in improving sorting equipment at MRFs and educating communities, which in part led to an additional 42 million pounds of recovered PP in the U.S.

## TEXTILES

- Textile recovery is relatively low at a 15% recovery rate, but is growing as a market. The textile recycling market is anticipated to reach a value of \$12.8 billion by 2032. The secondhand apparel market is equally growing, with an estimated value of \$350 billion.
- Michigan has supported textile recycling capacity through grants to Industrial Sewing and Innovation Center, an institute dedicated to finding solutions to overproduction of apparel. Goodwill of Michigan is looking to build a hub system to increase textile recycling and build a circular textile system in Michigan.

## GLASS

- Commodity values for recovered glass have been steady in recent years. Material values vary from -\$25 per ton to nearly \$60 per ton depending on color sorting and contamination.
- MRFs are investing in new technology and equipment including air separators, vacuum systems, and light removal to produce cleaner recycled glass products.
- Midwestern glass markets remain strong. Some manufacturing plants are located in southern Michigan as well as more throughout the region. Glass markets in the northern half of the state are weaker due to distances from the central markets of the Midwest, which could be addressed with additional investments.

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<sup>38</sup> The remaining recovered plastic film are agricultural other films.



# ECONOMIC CONTRIBUTION AND ECONOMIC IMPACT OF REACHING 45%

## ECONOMIC CONTRIBUTION OF THE RRR INDUSTRY TODAY

RRS conducted an economic contribution study of Michigan's COGs to analyze the contribution of the RRR industries on the state's economy. The RRR industries are a significant and integral component of Michigan's economy that encompasses the entire recycling value chain, from collection and processing to (re)manufacturing of recycled materials into new products that compete with virgin products in the market as well as repair and reuse.

To determine the value of the RRR industries to Michigan's economy, the study considered its direct, indirect, and induced economic contributions. Direct contributions refer to jobs within the RRR industries, while indirect contributions include the effects of business-to-business purchases in the supply chain. Induced effects stem from household spending of labor income. Together, these economic contributions demonstrate the vital role that the RRR industries plays in Michigan's overall economic well-being.

The RRR industries in Michigan create 72,500 jobs and contributes more than \$17 billion to the state's total economic output. Table 45 summarizes the direct, indirect, and induced economic contributions of the RRR industries in Michigan. Figures 38 through 41 show the direct, indirect, and induced employment, labor income, value added, and output respectively by COG.

Table 45: Summary of the Recycling, Reuse, and Remanufacturing Economic Contribution in Michigan in Millions of Dollars

	EMPLOYMENT	LABOR INCOME \$M		OUTPUT \$M
	44,400	\$3,100	\$5,270	\$11,680
Indirect	13,000	\$900	\$1,350	\$2,760
Induced	15,100	\$860	\$1,540	\$2,680
<b>Total</b>	<b>72,500</b>	<b>\$4,860</b>	<b>\$8,160</b>	<b>\$17,120</b>

Figure 37: Direct, Indirect, and Induced Employment by COG

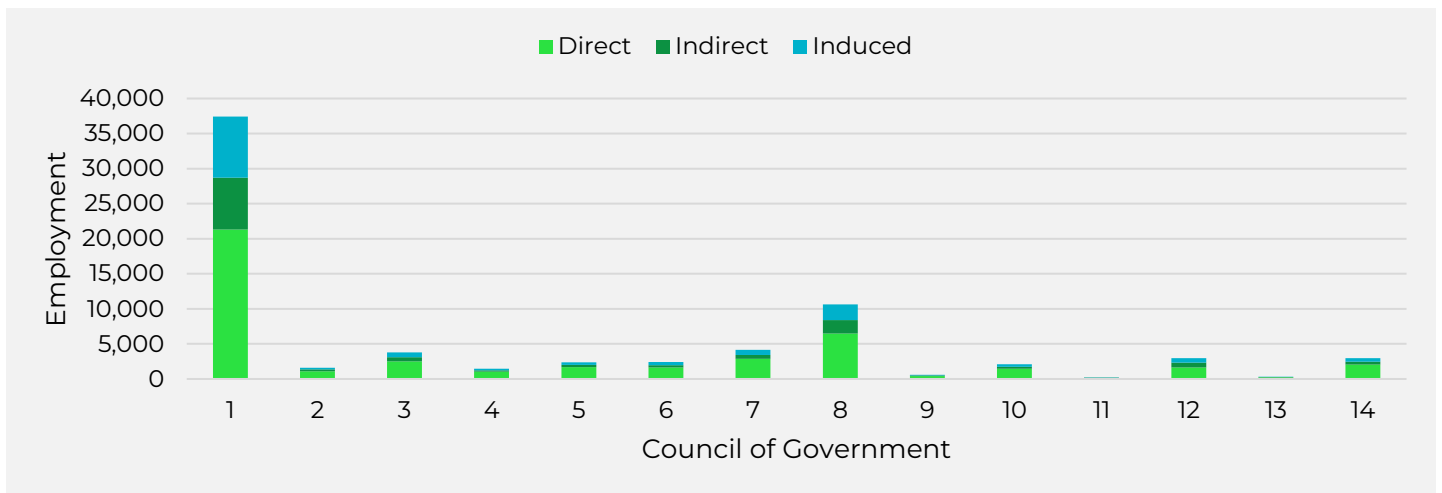


Figure 38: Direct, Indirect, and Induced Labor Income by COG

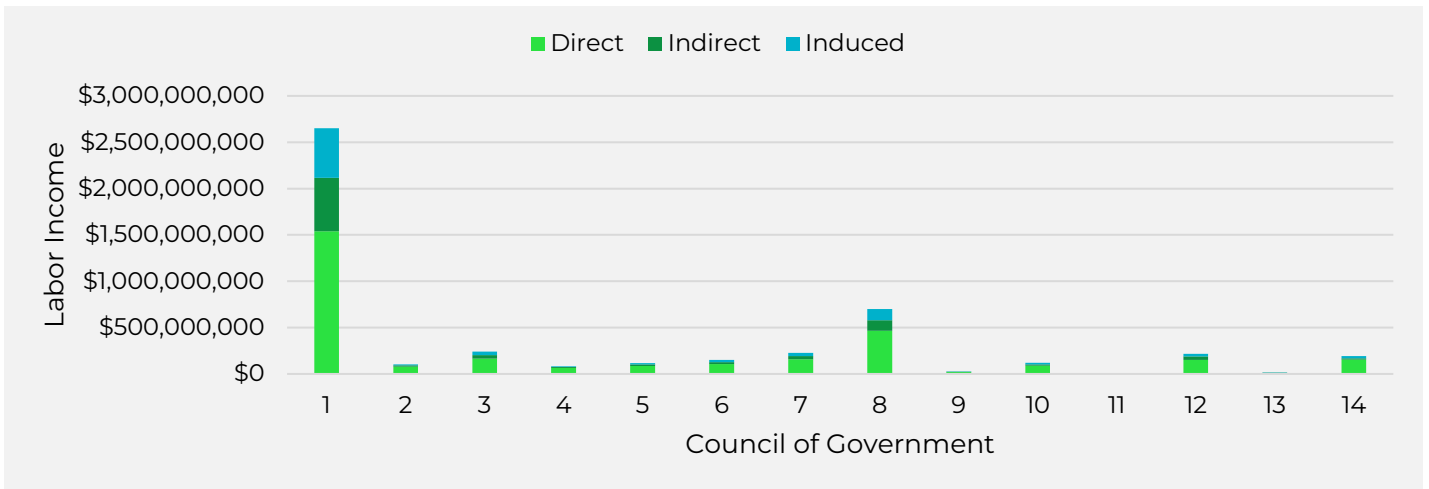


Figure 39: Direct, Indirect, and Induced Value Add by COG

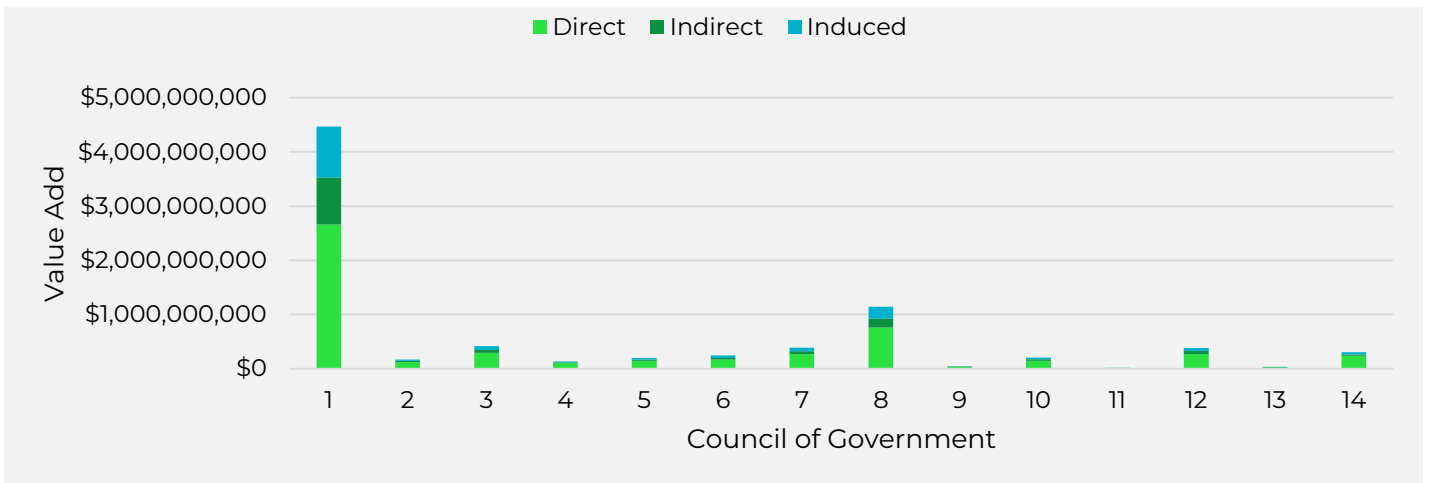
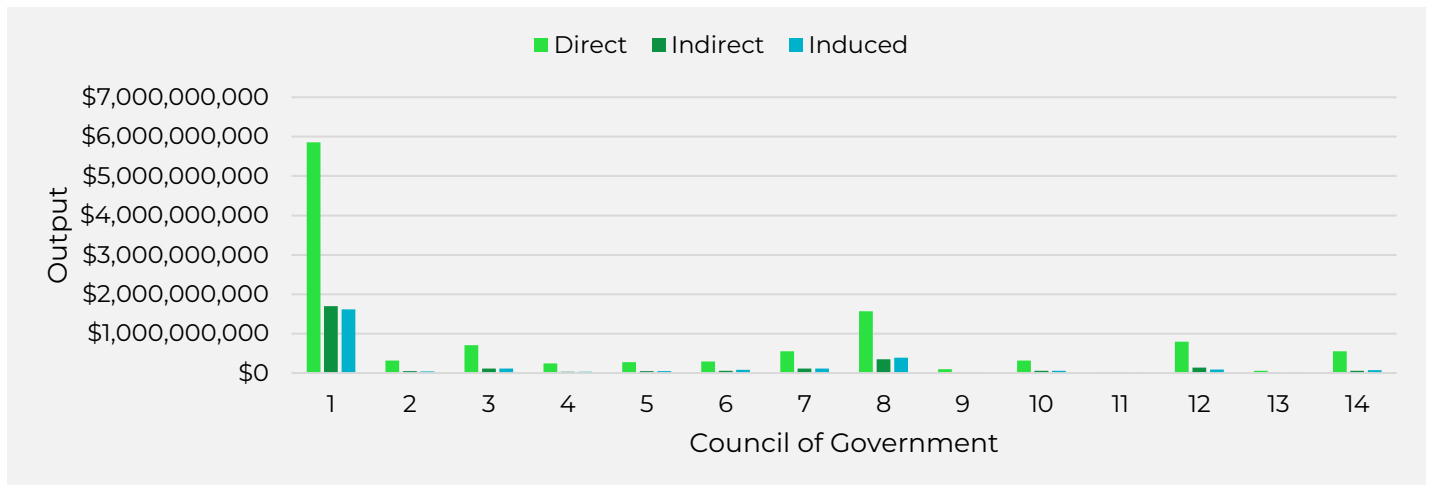


Figure 38: Direct, Indirect, and Induced Output by COG

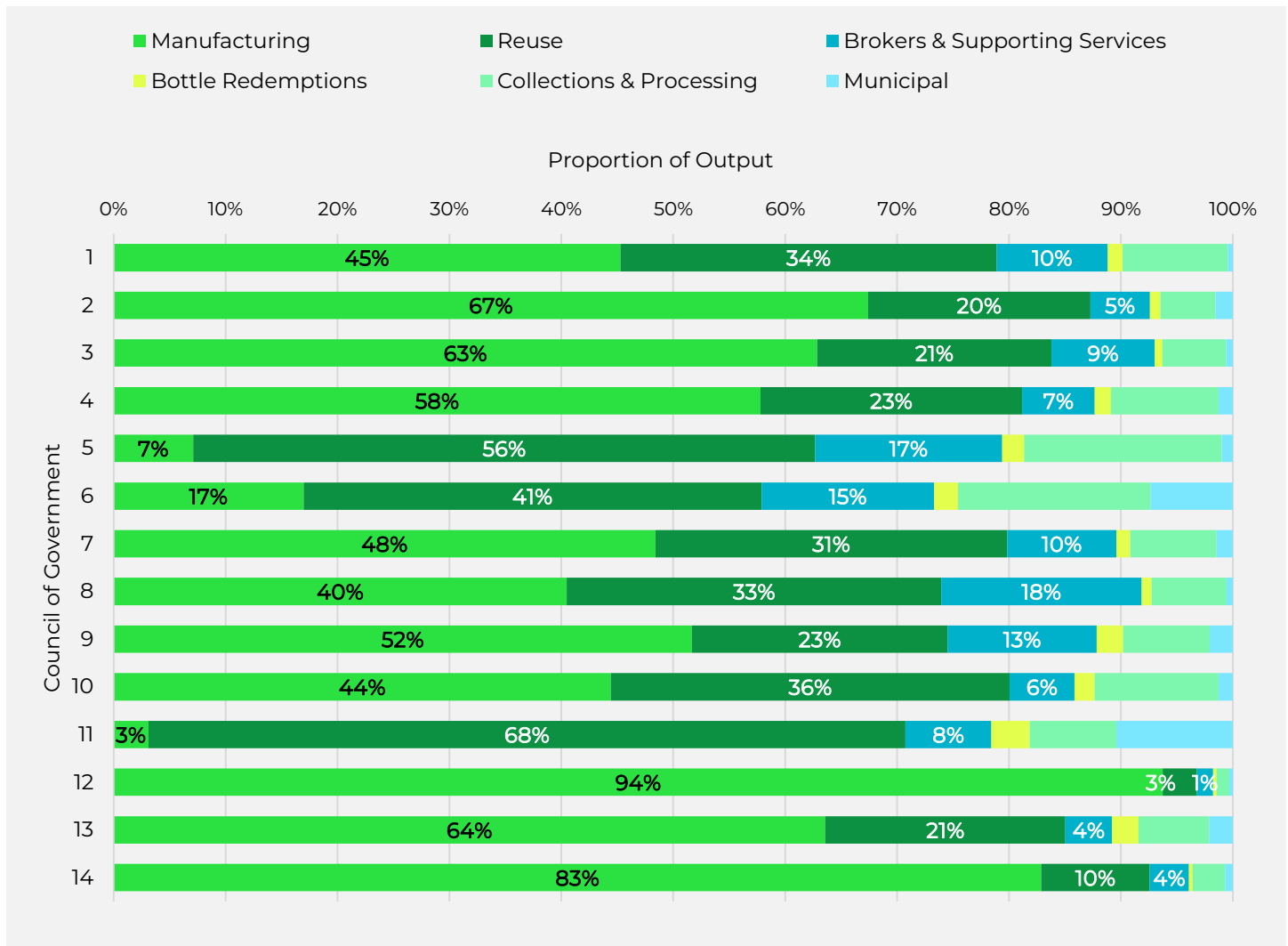


The economic contribution of the RRR industries to Michigan's economy can be divided into several key categories, including manufacturing, reuse, brokers and supporting services, bottle redemptions, collection and processing, and municipal support. The leading category in terms of the proportion of total economic output varies significantly across Michigan's COGs.

For instance, in COG 1, the largest COG in terms of population and economic activity, manufacturing accounts for 45% of the total RRR economic output, while reuse encompasses 34%. The remaining 21% is shared between brokers and supporting services, collection and processing, and municipal support for recycling programs. In COG 12, which includes the City of Marquette in Michigan's Upper Peninsula, manufacturing makes up 94% of the total economic output of the RRR industries.

Although there are significant variations in the proportion of output across the COGs, the manufacturing and reuse sectors are generally central to the economic contribution of the RRR industries in the state. Figure 39 illustrates the proportion of total output for each RRR category across the COGs.

Figure 39: Proportion of Total Output of Different Categories of the Recycling, Reuse, and Remanufacturing Industries by COG<sup>39</sup>

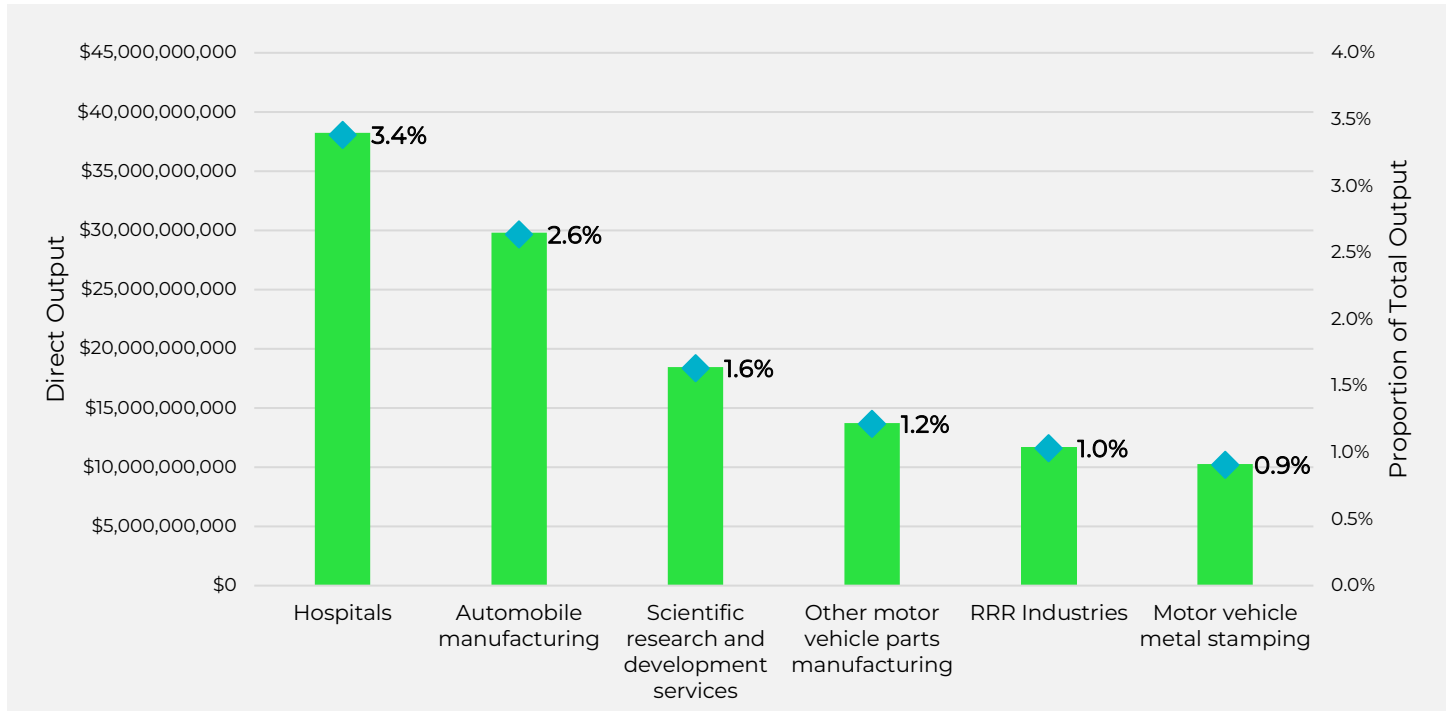


<sup>39</sup> Total output includes direct, indirect, and induced economic contributions.

The RRR industries in Michigan directly contribute 1% to the economic output of Michigan's economy. To put that in perspective the largest single contributor to the state's economy is hospitals at 3.4% of economic output, followed by automobile manufacturing at 2.6% (Figure 43).

The direct economic output contributions of the RRR industries fall between the direct output from other motor vehicle parts manufacturing and motor vehicle metal stamping, both of which play an important role in supporting Michigan's auto manufacturing powerhouse. Overall, the RRR industries rank within the top 20 industries in Michigan, out of over 500 different industries.

Figure 40: Comparison of Direct Output of the RRR Industries with Other Leading Industries in Michigan



## ECONOMIC CONTRIBUTION STUDY METHODOLOGY

The economic contribution study of the Michigan RRR industries includes the impacts of both supply and demand side activities in Michigan. On the supply side, the study includes the impacts of all activities involved in collecting, processing, selling, and using recovered items in the state. On the demand side, the study includes all activities up to the first point in which the materials are used or products have been completed. The study excluded waste to energy, incineration, refuse derived fuel and combustion activities.

RRS reviewed the 2022 North American Classification System (NAICS) information to identify the businesses involved in RRR in Michigan. The list was updated from a previous economic contribution study RRS conducted for Michigan in 2019 and revised to reflect RRS' current understanding of the RRR industries in the state today. The following business activities were considered in the research:

- Businesses and organizations involved in the collection and transportation of RRR materials, including both private and public sector collectors;
- Intermediate processing of recovered scrap materials or reused products and items, including activities such as sorting and cleaning as well as disassembling, consolidating, composting and densifying;
- Reclaiming materials used for manufacturing inputs;
- Manufacturing of products using recovered materials;
- Wholesale or retail establishments selling used, repaired, recovered, or reclaimed materials; and
- Businesses supporting the industries above through research, consulting, equipment sales, engineering and brokering.

RRS used secondary research to determine the number of employees directly engaged in RRR activities in the state and to estimate what percentage of a sector’s business activity is related to RRR for each of the NAICS codes. The secondary research included sustainability reports, peer reviewed journal articles, and published information from trade organizations. For instance, while there are multiple paper mills in the state, 100% of the activity at 100% of the paper mills is not directly related to RRR. In fact, only a portion of the activities at the paper mills directly use recovered fiber as inputs in their process, thus the impact of paper mills on the state’s economy needed to be discounted by the percentage of the business activity that is not related to RRR. When there was an option to choose from multiple data sources for the recycling factor, RRS staff chose the more conservative from the published reports so as to avoid overstating the impacts in the state. As much as possible, RRS excluded internal industrial recycling in the economic analysis.

RRS utilized the economic input-output model IMPLAN to perform the economic modeling based on the above research. The data year for the economic analysis was 2022 and all values are reported in 2023 dollars.

## ECONOMIC IMPACT OF REACHING 45% DIVERSION RATE

In 2019, RRS conducted an economic impact study to assess the benefits of achieving a 45% diversion rate in Michigan. While this study was conducted several years ago, it still represents an accurate picture of the total impact of increasing diversion on the state’s economy. The study revealed that if the state were to reach this goal, it would lead to the addition of 47,800 jobs, \$3.3 billion in labor income, \$4.9 billion in total value added, and \$11.6 billion in total output to the Michigan economy (Table 46). Moreover, the study found that tripling the recycling rate would result in a substantial increase of around 60% in all aspects, including employment, labor income, total value added, and output, for the RRR sectors so that achieving a higher recycling rate has the potential to generate significant economic benefits for Michigan and its residents. With a 45% diversion rate, the total economic output of the RRR industries would be comparable to the direct economic output of Michigan’s breweries, wineries, and restaurant industries.

Table 46: Direct, Indirect, Induced and Total Impacts of RRR in Michigan

IMPACT	EMPLOYMENT	LABOR INCOME \$M	VALUE ADDED \$M	OUTPUT \$M
Direct	17,300	\$1,560	\$2,200	\$6,650
Indirect	14,600	\$970	\$1,470	\$2,760
Induced	15,900	\$730	\$1,270	\$2,210
<b>Total</b>	<b>47,800</b>	<b>\$3,260</b>	<b>\$4,940</b>	<b>\$11,630</b>

## SECTION SUMMARY

### ECONOMIC CONTRIBUTION OF THE RRR INDUSTRY TODAY

- The RRR industries in Michigan creates 72,500 jobs and contributes more than \$17 billion to the state’s total economic output, with room to grow. As Michigan grows its role in RRR, it brings new jobs.
- Manufacturing accounts for half of the total economic output from RRR industries; increasing recycling in Michigan would create more manufacturing jobs.
- Michigan’s RRR industries rank among the top 20 industries out of more than 500, with a direct output that accounts for 1% of the state’s total economic output. This places the contribution of RRR industries on the same level as crucial supporting industries for auto manufacturing, such as motor vehicle parts manufacturing and motor vehicle stamping.

### ECONOMIC IMPACT OF REACHING 45% DIVERSION RATE

- Achieving a 45% recovery rate in Michigan could result in an additional 47,800 jobs, \$3.3 billion in labor income, \$4.9 billion in total value added, and \$11.6 billion in total output would be added to the Michigan economy, placing the total economic output of the RRR industries on par with the direct economic output from breweries, wineries, and restaurants in Michigan.

# PROJECT AND INFRASTRUCTURE INVESTMENT

## PROJECT INVESTMENTS

Table 47 shows the total project investments since 2019 into Michigan’s circular economy including education and outreach, recycling and organics collection, processing infrastructure, and end market development. In total more than \$771 million has been invested, including EGLE investment since the founding of the Renew Michigan Fund, as well as public and private funding. Figure 43 shows the proportion breakdown of funding sources. The majority of funding, 83%, is private funding<sup>40</sup>.

Table 47: Project Investments since 2019

INVESTMENT TYPE	AMOUNT
Public Funding	\$98,820,295
EGLE Investment	\$29,262,619
Private Funding	\$643,473,165
<b>Total</b>	<b>\$771,556,079</b>

Figure 41: Breakdown of Public and Private Investment for Planned, Underway, and Complete Projects

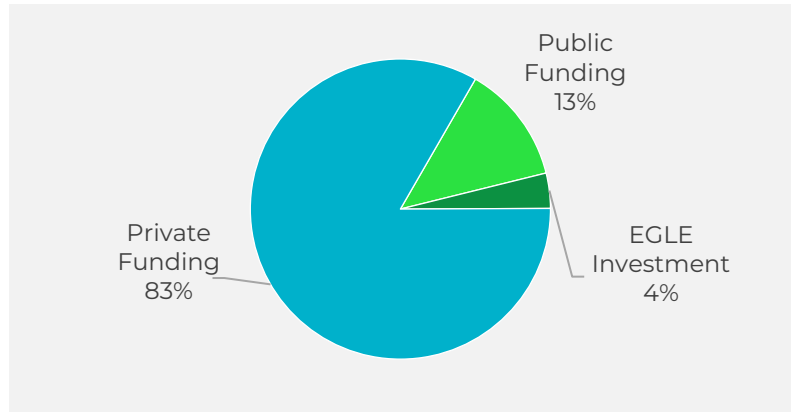


Figure 44: Map of Project Investments with Disadvantaged Communities Overlay<sup>41</sup>

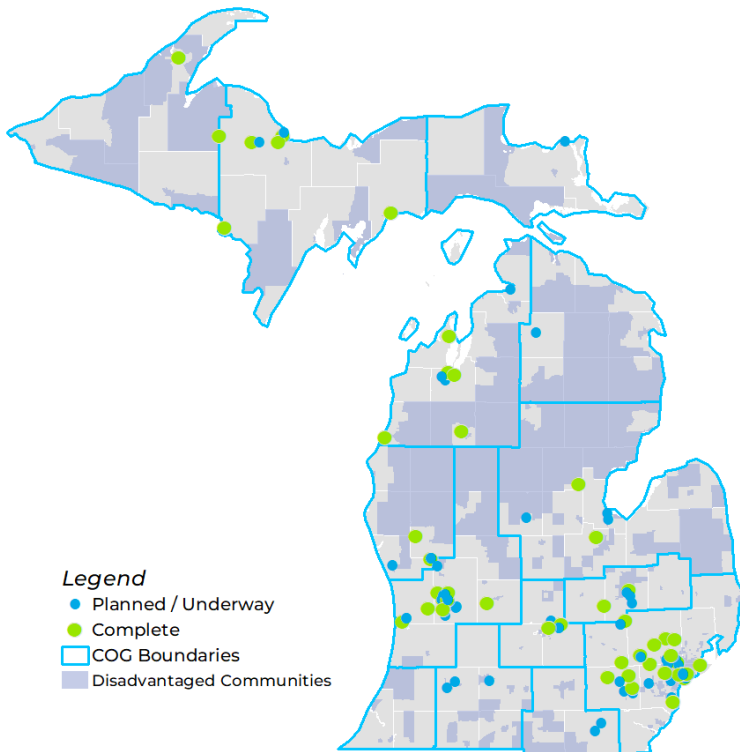


Figure 44 shows how investments line up with disadvantaged communities across the state. Additional projects have been completed and are underway in the state but are not shown for privacy reasons.

<sup>40</sup> Project Investments are tracked regularly tracked by the RRS team.  
<sup>41</sup> Interactive map available at <https://nextcyclemichigan.com/learning-center>

## NEEDED CAPITAL INFRASTRUCTURE INVESTMENTS

### MATERIAL RECOVERY FACILITIES

Table 48 shows the total additional capital investment needed to process an additional 1.2 million tons of mixed recyclables assuming that all the additional recyclables would be processed at newly built MRFs in Michigan, and each new MRF would operate two shifts per day. It is likely that current MRFs may be able to accept additional tons for processing so that the total needed new MRFs projected for the state could be lowered and thus the total capital investment. However, the purpose of this calculation was to estimate a likely maximum capital expense required for new MRF builds as part of reaching the 45% diversion rate. Note that mixed recyclables processed at MRFs are only a part of the total diversion needed to reach 45%. Other components that also need to be diverted and do not factor into the MRF capital investment calculation include drop-off items such as plastic film, bulky plastics, scrap metal, electronics, mattresses, and textiles and organics, such as yard, food, and wood waste.

The total estimated capital per MRF includes capital for new equipment, new rolling stock, a new building, land, and site work. Any costs associated with the capital based on factors like the amortization period and interest rate are not included.

Table 48: Estimated Capital Investment for Additional Needed MRF Processing Capacity

TONS PER HOUR	# OF SHIFTS	MRF SIZE CLASSIFICATION	TOTAL # OF MRFs	TOTAL CAPITAL PER MRF (MILLIONS)	TOTAL CAPITAL (MILLIONS)
15	2	Medium	22	\$16	\$357
35	2	Large	10	\$35	\$334
50	2	Extra Large	7	\$45	\$301

### COMPOST FACILITIES

Table 49 shows the total additional capital investment needed to process an additional 1.0 million tons of organics at new organics processing facilities, with 46% of those total tons being food waste. While it is possible that compost sites across the state could accept some food waste moving forward, it is not currently known the proportion of food waste that could be recovered with Michigan's current infrastructure or what the capacity is for current compost sites to expand. The vast majority of currently operating compost sites in Michigan utilize low tech windrow operations ideal for processing yard waste. While windrow technology can accommodate some food waste into the organics mix, technology such as covered aerated static pile (CASP) composting is preferable for processing more food waste mixed in with other organic material such as yard waste and wood chips in order to meet the percent of non-yard waste material limitation placed on open air composting facilities by EGLE.

The total estimated capital per compost site includes capital for new equipment, new rolling stock, new buildings, and site work. Any costs associated with the capital based on factors like the amortization period and interest rate are not included. Due to a majority of the new compost tonnage being food waste, new compost sites are used in the estimate to better handle this material versus adding it to existing sites.

Table 49: Estimated Capital Investment for Additional Needed Organics Processing Capacity

TONS PER YEAR	COMPOST SITE SIZE CLASSIFICATION	TOTAL # OF COMPOST SITES	TOTAL CAPITAL PER COMPOST SITE (MILLIONS)	TOTAL CAPITAL (MILLIONS)
10,000	Small	75	\$3	\$225
30,000	Medium	25	\$7	\$175
70,000	Large	11	\$15	\$165

## DROP-OFFS

Drop-off infrastructure that provides access for residents to recycle materials such as plastic film, bulky plastics, scrap metal, textiles, carpet, batteries, and electronics as well as additional access to MRF compatible recyclables is needed across Michigan. The goal should be to ensure convenient access for all Michigan residents and that includes minimizing drive time to facilities and establishing hours or days of operation that meet a community's needs. It is challenging to estimate the needed capital investment in drop-off sites for several reasons. The cost of establishing a drop-off site can vary widely depending on the size and scale of the drop-off site such as planned acreage and scale of activities at the site. Many communities may already have some drop-off sites established that could be expanded to increase access to residents. Additionally, communities may consider temporary drop-off sites to provide access for residents where a full-time drop-off site is not feasible.

Figure 13 of this report shows drop-off sites across the state as well as indicating who can utilize those sites. Often drop-off sites specify which residents can use the site, limiting access to residents of a community, township, or county. Ideally, communities, townships, and counties would collaborate on siting new drop-off sites to ensure access is provided to as many residents as possible while also minimizing any overlap in sites that would increase operational cost.

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## SECTION SUMMARY

### PROJECT INVESTMENTS

- Since 2019, more than \$771 million has been invested into Michigan's circular economy, with the vast majority, 83%, of that funding coming from the private sector.

### NEEDED CAPITAL INFRASTRUCTURE INVESTMENTS

- If Michigan were to build all new MRFs to process the additional 1.2 million tons of MRF compatible recyclables, the estimated total capital investment needed is between \$301 and \$357 million.
- If Michigan were to build all new compost facilities to process the additional 1.0 million tons of organics and compostables, the estimated total capital investment needed is between \$165 and \$225 million.
- Additional capital investment will be needed across the state to support access to other recycling via drop-off programs.



# STATE-LEVEL POLICY AND FUNDING MECHANISMS

In the past several years, the introduction of recycling- and diversion-focused legislation has expanded across the U.S., and the growing trend towards policy as a tool to manage the end-of-life of materials is expected to continue through 2023, 2024, and beyond. Active state legislation being introduced, and in some instances passed, include Extended Producer Responsibility for Packaging and Paper Products (EPR for PPP), additional or expanded beverage container DRSs, recycled content mandates, and mandatory recycling laws.

In 2022, Michigan passed the largest overhaul in the state's waste management laws in decades with the goal of increasing recycling rates. The policy section of this report reviews the recent progress Michigan made in moving the state from disposal management to materials management with an emphasis on prevention, reuse, and recycling, and outlines other policy and funding approaches Michigan could take to reach the state's diversion goals. Each potential policy approach is accompanied by a description of the benefits the policy could bring to the state with the implementation of best practices.

## MICHIGAN POLICY AND FUNDING BACKGROUND

### POLICY

An eight-bill package proposing major changes to the Michigan Solid Waste Law also known as Part 115 was passed in Michigan in 2022. Before the policy revamp, Michigan's Solid Waste Law focused on ensuring disposal capacity in the state whereas the updated policy package focuses on increasing supply of recyclables through universal program access to residents, mandatory recycling requirements for haulers, and funding opportunities for municipalities to implement diversion programs. A summary of the package of laws is provided in the bullets below.

- *House Bill 4454 2022* – Establishes the BRSs, setting a minimum level of recycling program access for communities in Michigan that varies based on population size.
- *House Bill 4455 2022* – Lays out definitions for facilities and communities and establishes the 45% recycling rate goal for the state.
- *House Bill 4456 2022* – Adjusts fees on disposal areas and waste disposal centers, and allows for EGLE to enter, inspect, and monitor sites and facilities.
- *House Bill 4457 2022* – Establishes financial assurance requirements for site clean-up in cases of bankruptcy and catastrophic failures. The financial assurance applies to landfills and other materials management facilities.
- *House Bill 4458 2021* – Allows the state to develop a materials management plan for a county that chooses not to develop their own plan.
- *House Bill 4459 2021* – Allocates Renew Michigan funds for planning, grants, and loans for market and infrastructure development, education and outreach, and economic development.
- *House Bill 4460 2021* – Updates regulations and increases oversight on compost facilities, recycling plants, and anaerobic digesters.
- *House Bill 4461 2022* – Updates County materials management plans, previously referred to as solid waste plans. The updated plans are required to address how a baseline level of recycling access will be provided to county residents to meet the state's diversion goals. The Bill also establishes funding for counties: \$60,000 annually per county with an additional \$0.50 per capita not to exceed \$600,000 in the first three years of a planning cycle.. The movement towards materials management plans in Michigan are part of a broader goal to address greenhouse gas emissions.

Other diversion policies that Michigan has enacted include disposal bans on materials such as beverage containers, yard waste, and scrap tires (Department of Environment Great Lakes and Energy 2023e)<sup>42</sup>. Disposal bans can drive awareness that certain materials must be diverted, as well as accelerate development of alternatives to disposal. When coupled with collection and processing programs and education and outreach efforts, these policies can greatly increase material diversion.

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<sup>42</sup> There are several other categories of materials banned from disposal in non-hazardous solid waste landfills in Michigan that are not listed in this memo. See: <https://www.michigan.gov/egle/about/organization/materials-management/solid-waste/landfill-prohibited-materials-and-appropriate-disposal-options> for a complete list.

As mentioned earlier in this report, Michigan also has a beverage container deposit law enacted in 1976. Historically, redemption rates have been above 90% in Michigan, but rates have been falling year-over-year starting in 2010, with a significant drop-off in 2020 when the redemption rate only reached 73%. Redemption rates recovered slightly in 2021 and 2022, but have remained below 76% (Department of Environment Great Lakes and Energy 2023c). Despite the falling redemption rates, the recycling rate for deposit containers remains significantly greater than the overall recycling rate for similar containers not eligible for redemption in Michigan (Container Recycling Institute 2015). The 2021 average PET Bottle collection rate in the U.S. was 28% (NAPCOR 2022).

## FUNDING

### Renew Michigan Fund

Funding for the materials management policy approach will come from the Renew Michigan Fund passed in 2018. Revenue for the Renew Michigan Fund is raised through online retail sales (Paker 2019). A total of \$69 million will be deposited into the fund annually with allocation as follows:

- \$9 million allocated to regulatory oversight of the materials management industry;
- \$15 million allocated to annual support for recycling infrastructure, market development, and county planning;
- And \$45 million allocated to brownfield remediation.

EGLE's annual Recycling Grants are supported by the Renew Michigan Fund. Various annual grants are made available to local government, tribal organizations, non-profit, and for-profit entities to support Michigan's materials management system to grow recycling in the state. Respondents are required to submit proposals to EGLE for evaluation and selection is based on program priorities, criteria, and eligibility. (Department of Environment, Great Lakes and Energy 2023). In Fiscal Year 2022, EGLE awarded 15 grants via the Renew Michigan Fund for a total of \$8.96 million (Department of Environment, Great Lakes and Energy 2023c).

### Unredeemed Deposits

Unredeemed deposits in Michigan are used to support several funds in the state. The first is the Bottle Bill Enforcement Fund for the Michigan State Police which funds enforcement of Michigan's bottle bill and investigations into violations. Once disbursement of the first \$1 million to the Bottle Bill Enforcement Fund occurs, the remaining 75% of the funds go into the Cleanup and Redevelopment Trust Fund and the Community Pollution Prevention Fund, which are used to clean up contaminated sites in Michigan and educate Michigan residents and businesses on hazardous materials and pollution prevention, respectively. The final 25% of unredeemed deposits are returned to retailers to cover the handling of redeemed containers.

### Other Funding Sources

Michigan's Scrap Tire Program is used to support local municipalities with tire cleanup efforts, provide public and private grants promoting scrap tire markets in the state, and ensure adequate resources are available for compliance and enforcement of Michigan's scrap tire laws (Department of Environment, Great Lakes and Energy 2023e).

The Pollution Prevention Grants Program provides matching grant funding to local and county government, local health departments, municipalities, regional planning agencies, and non-profit organizations that aim to address two objectives (Department of Environment, Great Lakes and Energy 2023a):

- Develop a statewide roadmap for food waste reduction at any point in the supply chain, and
- Develop a statewide toxics reduction roadmap for state and local decision makers that provides recommendations on policies and programs to reduce the use of toxic materials in the state.

The update to Michigan's Solid Waste Law now being implemented along with the Renew Michigan Fund are a crucial step forward for the state's efforts to increase diversion. While the Renew Michigan Fund provides a major boost to recycling funding in Michigan, reaching the state's 45% diversion goal will likely require significant investment in the state's materials management system including collections, processing, end market development, and education and outreach. As shown in the previous section, capital investments into MRFs and organics processing facilities could range from \$301 to \$357 million and \$165 to \$225 million respectively. Michigan will also need to invest in collection infrastructure such as carts, trucks, and drop-off sites, and support for end market development to achieve higher diversion goals.

In addition to capital investments, diverting material requires annual program funding by local governments, including MRF processing fees. The average MRF processing fee as of 2020 was \$64 per ton and could range up to \$100 per ton (The Recycling Partnership (TRP) 2020). At that rate, the annual average processing cost for an additional 1.2 million tons of mixed recyclables is between \$77 and \$120 million. While some of that cost would be offset for municipalities by reduced disposal costs and revenue sharing from commodity sales, commodity values are variable and cannot be relied on to consistently fund recycling programs. The vast majority of processing costs will need to be funded through taxes and fees charged to residents and businesses receiving services. Processing costs are only a portion of the cost to ensure functioning diversion programs, adequate collection and education and outreach efforts are also crucial. Michigan could consider diversion-focused policies that would provide additional funding to support the state's material management system and allow Michigan to fast-track efforts to reach 45% diversion.

## EXTENDED PRODUCER RESPONSIBILITY (EPR)

EPR programs require producers, typically brand owners, to take responsibility for their products and/or packaging at the end of their useful life, and are intended to increase diversion of materials, reduce cost to governments and taxpayers, incorporate the cost of recycling and end-of-life management into product manufacturing, and improve product design to reduce environmental impacts. EPR programs can target hard to recycle materials such as paint, electronics, mattresses, and batteries, and extend to materials such as beverage containers (bottle deposit laws), and packaging and paper products. There are a variety of structures and material types that can be covered under an EPR program. In general, there are three approaches to EPR programs:

- *Full responsibility models*– Producers are responsible for both program operation and financing.
- *Full financial responsibility*– Producers provide financial support for municipally-implemented collection programs.
- *Partial responsibility*– Producers provide partial financial support for municipally-implemented collection, with the remaining funding coming from consumers/taxpayers.

A key component of EPR programs is data tracking, reporting, and transparency to ensure the program is fulfilling the requirements of the legislation. Under EPR programs, producers must report sale volumes and the volume of materials collected for recycling within a state. In some instances, a third-party operator will then verify the reported data. Additionally, there may be performance targets established either by the legislation directly or through a Producer Responsibility Organization (PRO) which can be either a for-profit or a nonprofit organization that administers an EPR program on behalf of the producers. EPR programs also generally try to address concerns of overburden on small producers by providing exemptions or requiring only a fee to reduce their administrative burden.

## EPR PROGRAMS FOR PACKAGING AND PAPER PRODUCTS (PPP)

EPR programs for PPP started developing in Canada in the early 2000s, and programs are currently in place in eight provinces. In the last two years, EPR has been implemented in four states in the U.S.: Maine, Oregon, Colorado, and California. EPR for PPP legislation was also introduced with the possibility of advancement in Illinois, New York, Connecticut, Rhode Island, Maryland, and Hawaii. These programs typically encompass recyclable and non-recyclable residential (consumer-facing) packaging and printed paper, including materials sold by online retailers. Some programs extend EPR to cover residential material that may be collected in public spaces. Few programs include commercially- or industrially-generated PPP. EPR programs for PPP include some or all of the following categories: packaging; paper products; single-use items; and packaging sold as a product. In all four states with EPR for PPP, exemptions include items such as perishable-food packaging, businesses suffering from financial hardship, medical products and drugs, and infant formula. Summarized below are three of the EPR for PPP packaging programs currently enacted in the U.S. to exemplify programs utilizing the three approaches of EPR for PPP.

- *Colorado full responsibility EPR law for PPP*– In 2022, Colorado passed a full responsibility EPR law for PPP that requires producers to be financially and operationally responsible for the collection and recycling of their packaging and paper products. The exact method of collection services for the covered materials, curbside, drop-off, or other means, was not prescribed in the bill, but recycling collection is now required to be as convenient as trash service for Colorado residents. From this law, municipalities will receive financial and operational support for implementing recycling programs. In areas where municipalities do not provide collection, the EPR program, through service contracted by the PRO, must ensure collection programs are in place so that no area of the state is left without

recycling access. Materials that must be covered within the curbside collection system include packaging, paper, and food service single-use items. Materials not included in the program are items intended to be used for at least five years and paper products used for a print publication such as news and current events (House Bill 22-1355 2022).

- *Maine full financial responsibility EPR for PPP* – In 2021, Maine passed the first law in the nation requiring producers to take financial responsibility for the recycling of packaging at the end of its useful life. In Maine's system municipalities will continue to provide collection services to residents either through municipal collection and processing or contracted services, and the producers will be responsible for fully funding the collection and processing costs of the covered packaging materials. The state will issue a request for proposals for a PRO, which will be required to collect funds from the brands that sell packaging into the state and reimburse municipalities and service providers for the cost of recycling. The state anticipates selecting a PRO in 2026, with the first payments being made to municipalities in 2027 (House Bill 1146 2021).
- *Oregon partial responsibility EPR for PPP* – Oregon passed the Plastic Pollution and Recycling Modernization Act in 2021 which will come into effect in July 2025. The law is a regulated stewardship model that will share recycling system costs between residents, businesses and institutions, and producers. The existing recycling system will remain in place and continue to be overseen by municipalities in most instances. Funding from producers will be used to enhance the system through expansion of recycling program access, both curbside and drop-off, conducting education and outreach campaigns, and investing in improvements to processing infrastructure and end market development. Producers will only be responsible for providing financial investment to increase recycling for covered materials include packaging, nondurable material used in storage, shipping, or moving, printed, and writing paper, and foodservice ware intended for single use. The program will be administered by one or more PRO(s) that are required to submit plans to the Oregon Department of Environmental Quality (DEQ). In total, producers are anticipated to cover approximately 25% of the total cost of the recycling system with the remaining cost covered by consumers (Senate Bill 582 2021; Redling 2021).

## OPPORTUNITIES FOR MICHIGAN

An EPR program for PPP would provide a major funding opportunity for Michigan as the state implements the BRSs and materials management planning process. Both Michigan's current diversion policy and EPR programs are considered supply-side policies that aim to increase collection and processing of materials. Michigan's newly revamped policy provides the framework for how to increase recycling supply while an EPR program for PPP would provide additional financial support for implementation and ensure recycling targets can be met. As mentioned earlier in this memo, the current funding mechanism for Michigan's Solid Waste Law is the Renew Michigan Fund supported by consumer spending at online retailers, however, driving Michigan's material management system towards 45% diversion rate will take a considerable amount of capital and annual operating expenses above what can be supported annually by the Renew Fund alone. EPR for PPP would introduce financing from producers into the recycling system, ensuring that consumers are not the sole financial source for managing the end-of-life of products.

### Key Benefits of Policy

- *Financial support for universal program access* – Michigan's new BRSs is a step towards ensuring every household in Michigan has convenient access to recycling and will require financial support to municipalities for implementation. An EPR for PPP program would provide additional financial support from producers that could be utilized to implement programs and ensure performance targets are achieved.
- *Enhanced education and outreach campaign opportunities* – Currently education and outreach efforts are generally provided by the municipality or hauler to residents. Education and outreach can be infrequent and may not be consistent between haulers operating in the same area, creating confusion among residents. To be effective, education and outreach campaigns must be consistent and sustained. EPR for PPP provides the financial support needed for a consistent, ongoing statewide education and outreach campaign.
- *Regular data tracking* – EPR for PPP programs can require consistent data reporting from all producers, haulers, and sorters operating within the state to ensure the program is meeting performance requirements. While Michigan's Solid Waste Law ensures facilities comply with Part 115 reporting requirements, an EPR for PPP program would take reporting one step further by including producer reporting to provide additional information that could be tracked in tandem with facility data, giving Michigan a deeper insight into recycling program achievement in the state.

- *Investment in sorting and end markets* – Producers are incentivized to invest in sorting and end market developments to meet performance requirements and improve system efficiency such as optimized hub and spoke models.
- *Market stability* – Historically, haulers and processors have added and removed items from the recycling list depending on market behavior, often dropping materials as their values drop. This practice creates a chaotic system and causes distrust among consumers on what is and is not truly recyclable. Under EPR for PPP, funding for recycling programs is disconnected from material market value so that haulers and processors can continue to recover materials even when materials have low or negative values.
- *Substantial impact to recycling rate* – EPR for PPP programs have been shown to produce recycling rates greater than 50%, and in some places substantially greater (The Recycling Partnership 2023).

### Policy Best Practices

- *Performance requirements* – Establish recycling performance standards for an EPR for PPP program that aligns with Michigan’s 45% diversion goal and supports implementation of BRSs. Performance requirements should be grounded in achievable recycling rates for curbside and drop-off programs. These standards should be outlined in a PRO program plan approved by EGLE.
- *Program management structure* – Ensure the EPR for PPP program is managed by one or more PRO. The PRO’s activities should be guided by the program plan.
- *Transparency* – Strong reporting requirements that ensure that materials are being handled responsibly by providing visibility into how materials are being collected, sorted, and sold to end markets.
- *Clearly defined roles and responsibilities* – Spelling out the responsibilities of producers, service providers, municipalities, the state and other stakeholders, and defining accountability for each entity is key to ensuring program success.

## MINIMUM RECYCLED CONTENT REQUIREMENTS

Mandatory minimum recycled content laws require manufacturers to incorporate a minimum percentage of recycled content into their products or packaging. These laws are considered a demand-side approach to increasing recycling because they increase demand for recycled commodity by end markets and thus incentivize the processing of materials at MRFs, but do not drive an increase in collection programs as a stand-alone policy.

Minimum recycled content policies were first enacted in the 1990s, largely targeting newsprint and select plastic products. As of 2023, nine states have established minimum content requirement laws for newsprint, and five states have enacted requirements for items such as fiberglass, glass containers, plastic containers, and plastic trash bags. The California minimum recycled content law is documented in more detail below as an example of the implementation of these types of laws.

- *California* – California has some of the most expansive minimum recycled content laws requiring post-consumer recycled content in glass food and beverage containers, plastic beverage containers, rigid plastic packaging containers, plastic trash bags, and plastic and paper retail bags. The Rigid Plastic Packaging and Containers Law provides producers with several pathways for compliance through reuse, reduction, recycling, or recycled content. The Recycled Content Trash Bag Program has strong reporting requirements and enforcement, including prosecution for fraud and reporting of false and misleading information. A complete list of the minimum recycled content laws and the materials they pertain to is provided in the table below.

Table 50: List of California's Minimum Recycled Content Laws

TITLE	MATERIAL SUMMARY
<b>Assembly Bill 793 2020</b>	Glass food & beverage containers <ul style="list-style-type: none"> <li>• 35% PCR by 01/01/22</li> <li>• 25% PCR by 01/01/22 (mixed color)</li> </ul> Plastic beverage containers <ul style="list-style-type: none"> <li>• 15% PCR by 01/01/22</li> <li>• 25% PCR by 01/01/25</li> <li>• 50% PCR by 01/01/30</li> </ul>
<b>Plastic Packaging Container (RPPC) Program 2006</b>	Rigid plastic packaging containers <ul style="list-style-type: none"> <li>• 25% PCR</li> <li>• Reduce container weight</li> <li>• Achieve at least a 10% product concentration or increase product concentration and reduce container weight</li> <li>• Use reusable or refillable packaging</li> <li>• Meet a 45% recycling rate.</li> </ul>
<b>Plastic Trash Bags 2008</b>	Plastic trash bags (>0.7 mils thick) 10% Actual Postconsumer Material (APCM) in trash bags sold in California or a minimum aggregate of 30% APCM in all plastic products sold in California.
<b>Senate Bill 270 2014</b>	Reusable plastic grocery bags <ul style="list-style-type: none"> <li>• 40% PCR</li> </ul> Paper carryout bags (>8 lbs. capacity) <ul style="list-style-type: none"> <li>• 40% PCR</li> </ul> Paper carryout bags (<8 lbs. capacity) <ul style="list-style-type: none"> <li>• 20% PCR</li> </ul>

## OPPORTUNITIES FOR MICHIGAN

Michigan could couple the recently passed supply-side policy with a mandatory recycled content requirement which functions as a demand-side policy. Taken together, supply-side, and demand-side policies complement each other, increasing collections and demand by end markets respectively. Key policy benefits and best practices are outlined in the bullets below.

### Key Benefits of Policy

- *Market stabilization and development* – Minimum recycled content laws create stable demand by manufacturers for recycled content. This provides certainty for processors that materials will retain value and continue to have end market demand, reducing the risk to invest in additional processing operations. In the past several years, Michigan has seen increased investment in new MRFs and retrofits of existing facilities to improve sorting, however, to reach the state’s 45% diversion goal Michigan will need to continue investment in processing infrastructure across the state.
- *Levels the playing field* – When all manufacturers are required to utilize a minimum recycled content, the risk to a single manufacturer for incorporating recycled content into the manufacturing process is reduced.
- *Reduce demand for virgin materials* – Incorporating recycled content into the manufacturing process would reduce the importation of virgin materials into Michigan and lower the state’s carbon footprint.

### Policy Best Practices

- *Pair with supply-side policy* – Supply of postconsumer plastic, glass, and paper is currently not enough to meet industry demand, particularly for food-grade plastic resins. These supply constraints would be exacerbated by a mandatory recycling law without any accompanying supply-side recycling policy. Mandatory recycled content laws should be paired with supply-side recycling policies like the update to Michigan’s Solid Waste Law and EPR for PPP programs to ensure increased collection occurs as demand for recycled content also increases.
- *Monitor material quality* – Increased collections alone is not sufficient to ensure enough supply for mandatory recycling laws if the quality of commodity coming out of MRFs is also not considered. Utilizing recycled content

in manufacturing processes, especially for food grade applications, requires high quality recycled materials. MRFs can produce high quality bales with the implementation of new sorting technology such as optical sorters, robotics, and artificial intelligence. Supporting processing investments in the state to ensure highest quality bales from MRFs coupled with funding from EPR legislation is critical to the success of mandatory recycling laws.

## DEPOSIT RETURN SYSTEMS

A DRS establishes a deposit on certain covered beverages at point of sale that is refunded to the consumer when the container is redeemed for recycling. Bottle bills are a form of EPR for beverage containers where producers initiate the deposit on the container that is then paid by the retailer and finally consumers. When the consumer redeems the container, they are paid back the deposit by the retailer who then receives the deposit back from the producer. In Michigan, and in most bottle bill states, producers are required to remit unredeemed deposits to the state. In addition to paying deposits, in some states producers are also required to pay handling fees to retailers and redemption centers to cover the cost of managing deposit containers. Generally, producers retain ownership of the value of the scrap material collected.

There are 10 bottle bill states including Michigan in the U.S. with varying deposit rates and covered items. In the past several years, DRS has been introduced in legislative sessions in several states, and states with bottle bills have amended or expanded their systems. Two examples of recently amended bottle bill laws by other states are presented below.

- *Connecticut* – Connecticut initially passed a bottle bill law in 1978. The law remained unchanged until 2009 when the state added non-carbonated bottled water to the list of covered beverages and restructured unredeemed deposits to be paid back to the state instead of retained by the distributor. The state updated the law again in 2021, increasing the deposit value from \$.05 to \$.10 and the handling fee to retailers and redemptions centers from \$.02 to \$.035 per container. Covered beverages were also expanded to include all non-carbonated beverages such as juice, energy drinks, tea and coffee, hard ciders, and malt-based hard ciders<sup>43</sup>. The changes are expected to take effect in 2024 (Container Recycling Institute 2023).
- *Oregon* – Oregon introduced the nation’s first bottle bill in 1971. In 2007, the state overhauled their DRS to address declining redemption rates and increase diversity of beverage types in the marketplace. The law added non-carbonated water to the covered beverages effective 2009. It also required stores 5,000 square feet or more to accept empty containers of beverages sold at the store, regardless of whether the specific brand was sold at the store. Stores occupying 5,000 square feet or less could limit the number of containers redeemed per person to 50 containers a day. In 2009, the Oregon Beverage Recycling Cooperative (OBRC) was formed to simplify the redemption and backhauling process of containers for distributors. The OBRC now operates redemption centers called BottleDrops statewide in Oregon. In 2011, the state passed another update to the bottle deposit system expanding the list of covered beverages to all beverages except wine, liquor, milk, and milk substitutes. There was also a redemption rate trigger to increase deposit values from \$.05 to \$.10 if redemption rates fell below 80% for two consecutive years. In 2018, the trigger went into effect and deposits were raised to \$.10 per container (Container Recycling Institute 2023). Oregon’s BottleDrop system allows consumers to redeem containers in multiple ways. Consumers can redeem containers using reverse vending machines or asking for a container hand count at any of the 26 redemption centers. Alternatively, consumers can utilize the Green Bag Program which allows residents to bag redeemable containers in specific green plastic bags and drop the full bags at redemption centers or participating retailers. The bags are marked with bag stickers that are tied to a consumer’s account. Once the redemptions are complete, the consumer can transfer funds to Venmo, PayPal, a bank account, or refund the money as cash or store credit (BottleDrop Oregon Redemption Center 2023).

## OPPORTUNITIES FOR MICHIGAN

Michigan’s bottle bill has been a success in the state, substantially increasing recycling rates for covered materials. In the past several years, likely spurred on by COVID, redemption rates have fallen significantly. Michigan could consider adjustments to the state’s bottle redemption system to increase covered materials and redemption convenience for consumers. Another potential to consider is raising the 10-cent deposit as inflation has eroded the value of redeeming containers. Legislation has been introduced in both the Michigan House and Senate in 2023 that would expand Michigan’s DRS to include more beverages such as tea, water, sports drinks, and hard cider and would also address

<sup>43</sup> The CT bottle deposit continues to exclude milk and plant-based milks from covered beverages.

convenience by allowing for universal redemption of all brands at large stores (Burr 2023). Key policy benefits and best practices are outlined in the bullets below.

### Key Benefits of Policy

- *High recycling rates for covered materials* – Michigan has had historically high recycling rates for redeemable containers in the state. However, recent redemption rates have declined significantly from 92% in 2017 to 76% in 2022 (Container Recycling Institute 2023). Even with declining redemption rates, the recycling rate of covered materials is significantly greater than the state’s overall recycling rate.
- *Financial support for the deposit system* – As mentioned in the Michigan and Policy Background Section of this memo, unredeemed deposits in Michigan are used to support the state’s bottle bill and fund hazardous waste reduction programs.

### Policy Best Practices

- *Convenient redemption centers and multiple pathways for redemptions* – Michigan lacks any direct handling fee paid to retailers for redeeming containers, meaning that redemption centers cannot financially operate in the state. This leaves retailers in Michigan solely responsible for managing returned containers. Michigan’s bottle bill lacks some of the convenience of Oregon’s bottle redemption system such as requiring redemptions of all brands per beverage type sold at large retailers and redemption centers, which could offer more flexibility in ways to return containers.
- *Financial support for material revenue loss at MRFs and/or communities* – The bottle bill reduces the volume of aluminum and PET cans and bottles going into MRFs. These commodities historically have high market value and are an important component of the per ton commodity revenue for MRFs. In the past several years, MRFs have moved away from relying on commodity value for revenue and have implemented processing fees for municipalities with revenue sharing of commodity value back to the municipalities. As a result, more municipalities in Michigan will see the impact of reduced commodity revenues due to the removal of aluminum and PET cans and bottles from the MRF stream. Michigan could address the falling revenue challenge through policy mechanisms that provide reimbursements either to MRFs or municipalities, or by implementing a bottle bill expansion along with an EPR program that would cover MRF processing costs.
- *Inclusion of a wide range of beverage containers and types* – The list of covered materials under Michigan’s bottle bill does not include any non-carbonated beverages such as water, sports drinks, or juice. These beverages have expanded in market share significantly since Michigan’s bottle bill was passed and represent a significant amount of material that could be included and recycled within the state’s bottle redemption system. Several other bottle bill states have amended their bottle redemption system to include non-carbonated beverages.
- *Support a bottle bill with unredeemed funds* – While a portion of unredeemed deposits goes to retailers in support of administering the bottle redemption system, there is no other direct financial support from unredeemed deposits funding collection, public education around recycling deposit containers, or addressing MRF costs.

## SINGLE-USE ITEMS TAXES AND FEES

The application of taxes and fees on single-use items has gained traction in the U.S. over the past several years as an effort to reduce plastic pollution, particularly in waterways. A common example are fees applied to single-use carryout retail bags. In general, consumers pay a fee on plastic and/or paper carryout bags at the point of sale. The fee is collected by the retailers, who are often required to remit all or some of the collected fees back to the municipality or the state. The revenue generated by fees is then used to support waste and litter reduction or recycling programs.

- *Colorado* – Beginning in 2024, all stores and retail food establishments will be prohibited from providing single-use plastic carryout bags to customers entirely and may only provide recycled paper carryout bags to customers for a minimum \$.10 fee per bag. The fee is imposed by the municipality or county in which the store is located, and the store must remit quarterly 60% of the carryout bag fee revenues back to the municipality or county. The remitted fees will be used to administer the program and provide education and outreach supporting waste diversion programs in the local communities. There are exceptions to the bag fee. For example, the fee does not apply to customers participating in a federal or state food assistance program (Colorado Department of Revenue 2023).



- *District of Columbia* – The District of Columbia began requiring all businesses that sell food or alcohol to charge a \$.05 fee for every carryout paper or plastic disposable bag starting in January 2010. Businesses retain \$.01 or \$.02 if it offers a rebate when customers bring their own bags. The remaining collected fee is remitted to the District of Columbia, which funds the Anacostia River Clean Up and Protection Fund (Department of Energy & Environment 2023). A driving force behind enacting the bag fee was a 2008 report that found that one of the largest source of litter in the Anacostia River was disposable plastic bags (“Anacostia Watershed Trash Reduction Plan” 2008). Since the bag fee has been in effect, volunteer groups cleaning up the Anacostia River are reporting approximately a 70% drop in the occurrence of plastic bags at clean-up spots (Powers and Grace 2018). Additionally, the bag fee generated \$2.1 million in revenue for the Anacostia River Clean Up and Protection Fund for fiscal year 2021 (Department of Energy and Environment 2022).

## OPPORTUNITIES FOR MICHIGAN

In Michigan, municipalities have been prohibited from banning, regulating, or imposing fees on the use of plastic bags and other containers since 2016 (Senate Bill 853 2016). However, with the change to Michigan’s legislature after the last election, legislation has been introduced to repeal Michigan’s law banning local governments from regulating plastic bags (Graham 2023). If repealed, local communities in Michigan would have the opportunity to generate additional revenue for recycling programs through single-use items taxes and fees and potentially reduce plastic bag pollution in Michigan’s waterways.

### Key Benefits of Funding Opportunity

- *Generate Awareness About Plastic Pollution* – Introducing taxes and fees on single-use items such as plastic or paper bags sends a signal to consumers that these items are not free and have an associated cost of disposal that impacts the community.
- *Potential for Substantial Waste Prevention and Reusability* – In response to the Colorado law, Walmart stores across the state are eliminating paper and plastic bags entirely at their checkouts, and instead asking customers to bring or purchase reusable bags (Kruegel 2023). If more retailers follow Walmart, there is the potential to significantly reduce plastic pollution in Colorado. According to Eco-Cycle, 4.6 million plastic bags are used every day in Colorado, and these items are one of the most common plastic pollutants in the state’s waterways (Nicholson 2022).
- *Source of Local Funding to Support Diversion* – The City of Castle Pines, Colorado (2020 population 11,036) anticipates the bag fee will generate \$30,000 to \$50,000 in revenue for the City annually (*The Castle Pines Connection* 2023).

### Funding Best Practice

- *Requirements for remitted fees* – Fees collected from the single-use item tax that are remitted back to the municipality or state should be designed to fund litter reduction and waste diversion program efforts.
- *Explicit Direction on Alternatives* – There can be unintended consequences to plastic bag bans such as stores profiteering off of the sale of reusable bags (Muposhi, Mpinganjira, and Wait 2022) or retailers switching to items that appear to be more environmentally friendly such as compostable bags without fully examining the acceptance of these products in regional organics facilities or the contamination of recycling streams. Plastic bag taxes and fee laws should be clear on the accepted alternatives for retailers and consumers.
- *Awareness of Cost Impacts* – A bag tax or fee can be an extra burden for low-income residents. Colorado has addressed this issue by implementing an exception to residents participating in a federal or state food assistance program.
- *Data Measurement* – Bag bans and taxes are controversial and there are concerns that the unintended consequences of bag taxes or fees are worse for the environment than the original disposal plastic bags. At the same time, and as shown in the District of Columbia, there are positive impacts to bag taxes and fees such as reduced litter. Michigan should consider conducting before and after policy implementation studies to determine the true impact of any bag tax or fee both in terms of product usage and overall greenhouse gas emissions and litter reduction.

## ORGANICS DIVERSION POLICY

In 2018, food waste comprised 22% of the total 292.4 million tons of MSW generated in the U.S. (US Environmental Protection Agency 2021). A policy mechanism for increasing food waste diversion from landfills includes food waste landfill bans or diversion requirements. Often food waste landfill bans or diversion requirements apply only to large generators or are implemented in a staged approach, requiring compliance from the largest generators first before expanding the requirement to smaller commercial entities or residents. The policies can also be written to support food waste prevention and donation before alternative to disposal options such as composting or anaerobic digestion are utilized. There are currently five states with either food waste landfill bans or mandatory food waste diversion policy including California, Connecticut, Massachusetts, Rhode Island, and Vermont. A challenge for all states working to capture food waste from disposal is ensuring adequate collection, processing, and end market infrastructure is developed to support the diversion efforts. Detailed below are three examples of food waste diversion or landfill ban laws.

- *California* – California enacted Senate Bill 1383 in 2016 which set targets to reduce landfilled organics waste by 75% and additionally ensure that 20% of currently disposed edible food was recovered for human consumption by 2025. Starting in 2022, municipalities were required to provide organics collection services to all residents and businesses, establish edible food recovery programs, conduct education and outreach within their communities, purchase products such as mulch and compost to meet their annual procurement targets, and plan for organics processing capacity. Following this in 2024, municipalities will be required to take actions against non-compliant entities (CalRecycle 2018). Now more than 18 months into the regulations taking effect, most cities and counties have complied with the law with 126 asking for more time (Rainey 2023). In 2023, the Little Hoover Commission published a report on the implementation of Senate Bill 1383, noting that from 2014, the baseline year of the bill, to 2020 organic waste going to MSW disposal increased in California. The report indicated that California is unlikely to achieve the 2025 organics diversion goal, and that the state needs approximately 8 million tons of additional processing capacity which is unlikely to come online before 2025. As a result the report recommends the state pause the implementation of Senate Bill 1383 to avoid undermining public confidence in the goals and investment in education and outreach throughout the state to reinforce the importance of reducing organics in the disposal stream (Little Hoover Commission 2023).
- *Connecticut* – In 2011, Connecticut became the first state to pass a commercial organics diversion law. The law went into effect in 2014 with a tiered approach to implementation. In the first year of implementation, commercial food waste generators such as grocery stores, resorts, conference centers, wholesalers or distributors, and industrial food manufacturers were required to divert food waste to authorized organics processing facilities with availability capacity if the generator was producing 104 or more tons of food waste annually and located within 20 miles of an authorized organics composting facility. In 2020, the law expanded to include businesses generating 52 more tons of food waste annually and starting in 2022 the threshold for compliance was reduced to 26 tons or more of source-separated organic material. Commercial entities are permitted to include food donation and food scraps sent to animal feed as diversion activities as well as composting. Connecticut defines source-separated organics as including food scraps, food processing residue, and soiled or unrecyclable paper that has been separated from nonorganic material. To help commercial businesses and food manufacturers to understand whether their establishment is within 20 miles of a permitted food scrap recycling facility, the state maintains online map displaying all processing facilities and their 20-mile radius<sup>44</sup>. Businesses within 20 miles of another state must be aware of potential organics processing facilities across the state line as the law does not specify that the 20-mile radius only applies to organics processing facilities located within the state. There are no monetary fines for non-compliance however the Connecticut Department of Energy and Environmental Protection may pursue enforcement against any non-compliant company that is making no good-faith effort to meet the requirements of the law (Department of Energy and Environmental Protection 2023).
- *Vermont* – In 2012 Vermont passed the Universal Recycling Law which banned the disposal of food scraps in the MSW stream by all generators, residents and businesses, starting in 2020. The state defined food scraps as including pre- and post-consumer food waste that could be used for food donation, animal feed, composting, or anaerobic digestion. The law required trash haulers to offer food scrap collection services to commercial customers including apartments with 4 or more units starting in 2020. An exception for commercial haulers is allowed if another hauler in the area is providing collection service and has the capacity to provide services to all customers (Vermont Agency of Natural Resources 2020). In 2023, researchers at the University of Vermont published results

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<sup>44</sup> CT Permitted Organics Recycling Facilities: <https://ctdeep.maps.arcgis.com/apps/webappviewer/index.html?id=7db1be6811e645aeaf3eca05c111774f>

from a residential and commercial survey across the state that took place in 2021 and 2022. The survey results found that prior to the food waste disposal ban, approximately 48% of food waste was separated from residential trash. The rate of residential separation of food waste from trash increased to 71% after the ban was implemented. Approximately 85% of residents reported that they compost some level of their food scraps, however 20% of respondents indicated that composting was hard or very hard for them. Respondents that reported difficulty with composting wanted more information on how to compost food scraps correctly, how to compost through the winter, and how to get rid of fruit flies. A total of 61% of residents felt morally obligated to take steps to keep food waste out of their disposal. Support for the food waste landfill ban was also found to be strong among commercial businesses with 88% of retail and food service establishments agreeing or strongly agreeing that they support the food scrap landfill ban. The survey also revealed a variety of ways commercial businesses were managing their food waste including a substantial portion indicating composting on-site, sending food waste to animal feed, donating food waste, and contracting with hauler to collect food waste separate from MSW. Food service businesses had the highest reported rate of a negative impact on operating costs, indicating that compliance with the law was costing these businesses more money than landfilling food waste. The reported negative operating costs were much lower for food retail businesses (Belarmino et al. 2023).

## OPPORTUNITIES FOR MICHIGAN

Capturing food waste from the disposal stream encompasses the largest portion of organic material that needs to be diverted to reach the 45% goal in Michigan. The success of landfill bans can be seen in Michigan's yard waste landfill ban passed on 1990. As mentioned previously in this report, the state reported composting more than 279,600 tons of yard waste in 2021. Tellingly, the estimated proportion of yard waste in Michigan's MSW stream is approximately 2%, substantially lower than the 7% estimated proportion of yard waste on average in the U.S. landfilled MSW stream (U.S. Environmental Protection Agency 2018). The yard waste landfill ban in Michigan has ensured that most communities in Michigan have some level of yard waste diversion programs, either curbside or drop-off and at minimum covering fall leaf collection. However, there is no policy currently in place in Michigan to require the diversion of food waste, and only 22 composting sites in the state accepted some amount of food waste in 2021. Michigan could implement a food waste diversion requirement or landfill ban similar to the state laws outlined above to substantially increase food waste diversion in the state. To ensure success, Michigan would want to ensure investment in adequate processing capacity including composting and anaerobic digestion, as well as opportunities for food waste diversion and diversion of food scraps to animal feed. The current percent limitation of non-yard clipping materials for small and medium-sized composting facilities in Michigan will need to be addressed in order for facilities to process the amount of food waste needed to reach the 45% goal. Similarly, the state should work to ensure adequate end markets are in place to support the processing infrastructure, such as requiring construction industries and municipalities to procure some or all of their landcover needs from composted materials.

Food waste landfill bans or diversion requirements need to be coupled with other policies that aid food waste diversion initiatives. For example, fear of liability can be a barrier to food donation from food manufacturers, retailers, and wholesalers. Michigan does not have any state laws encouraging food donation, however food waste donations made in the state are protected from liability according to the federal Bill Emerson Good Samaritan Food Donation Act. Michigan could consider additional protections for food donations such as protecting donations of food that is past-date as is done in several other states including Ohio, California, Oregon, Washington, Kentucky, Virginia, New Jersey, Rhode Island, and Massachusetts. States can also incentivize food donations through tax incentives. California for example, allows qualified taxpayers to claim a tax credit worth 15% of the wholesale market price of donated products, raw agricultural products, and processed foods to a California food bank. Qualified taxpayers include farmers, packagers, and processors but excludes retailers. Additionally, processors, distributors, and retailers selling agricultural products are eligible for a tax credit valued at 50% of the transportation costs of donated crops to eligible nonprofits (ReFED 2023). Finally, Michigan could provide clarity on food safety for donated food including donation guidelines including details on storage, labeling, and packaging requirements.

### Key Benefits of Policy Opportunity

- *Generate awareness of the importance of diverting food waste from landfill* – Vermont saw a significant increase in residential participation in food waste diversion efforts and feelings of moral obligation to reduce food waste in their disposal stream after the implementation of the state's food waste landfill ban. Additionally, the vast majority of businesses supported the food waste landfill ban, even in the instances the ban had a negative cost

impact for the business (Belarmino et al. 2023). Education and outreach to residents and businesses is crucial to generating awareness of the importance of diverting food waste from landfills, and policies such as a food waste landfill ban or diversion requirement can spur question, conversations, and outreach campaigns to grow awareness of the issue.

- *Contribute to 45% goal* – Food waste alone accounts for 18% of the total 2.67 million tons of MSW that needs to be diverted from the disposal stream for Michigan to reach the 45% diversion goal. Michigan cannot reach their diversion targets without addressing food waste in the disposal stream. Policy requiring food waste diversion or banning food waste from the landfill could provide a major boost the overall state diversion efforts.
- *Greenhouse gas emission reduction* – Landfills are the third largest source of human related methane emissions in the U.S. and the annual emissions are equivalent to the greenhouse gas emissions from nearly 23.1 million passenger vehicles driven for one year (US Environmental Protection Agency 2023). The emitted methane from landfills is a byproduct of the decomposition of organic material in an anerobic environment. Reducing the amount of food waste going to landfill would significantly reduce methane emissions from landfills.
- *Production of high-quality compost* – When composting or anaerobic digestion is employed to process organic material, a valuable commodity is produced that can be applied to improve soil heath and structure instead of simply wasting the potential by burying organic material in a landfill.

### Policy Best Practice

- *Continuous education and outreach to residents and businesses* – Both the California and Vermont organics diversion and landfill ban policies outlined above highlight the importance of continual education and outreach. In the case of Vermont, a statewide survey found that some residents remained unsure on how to correctly compost material even after the landfill ban was implemented. Continuous education and outreach is required to ensure compliance, understanding, and buy-in from residents and businesses into any diversion effort that entails extra steps or costs to do.
- *Investment in processing infrastructure* – A challenge for any state working to implement widespread food waste diversion is that in almost any region food waste processing infrastructure is not adequate to manage the entirety of the organic fraction of the MSW stream. A food waste diversion or landfill ban policy will fail if infrastructure to manage source-separated organics is not in place to accept material and process materials.
- *Ensure adequate end markets* – Infrastructure alone will not ensure success in a food waste diversion policy as processors will need end markets to purchase their finished products. End market support can be developed through policy that requires municipalities and state agencies to utilize finished compost in a variety of different applications such road, park, and grading projects.
- *Compliance requirements and enforcement components* – Enforcement of policy ensures entities are making good faith efforts to comply with the law and also provides the opportunity for state agencies to understand where weak points in the law exist and tailor education and outreach efforts as generator needs arise. Without compliance and enforcement, the state may be in the dark as to the effectiveness of the policy.

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## SECTION SUMMARY

### CURRENT POLICY AND FUNDING

- EGLE's Recycling Grants are providing vital support for local governments, tribal organizations, non-profit, and for-profit entities to grow recycling programs and opportunities throughout the state, and the grants are already having positive impacts in diverting waste and growing jobs across Michigan.
- Michigan is moving away from disposal management and towards a wholistic materials management approach that encourages waste prevention, reuse, and recycling. Developing and strengthening waste reduction and diversion program across Michigan is part of reducing the state's greenhouse gas emissions and a necessary component of reaching the 100% carbon neutral goal by 2050.

## EXTENDED PRODUCER RESPONSIBILITY FOR PACKAGING AND PAPER PRODUCTS

- Enacted in four U.S. states, EPR for PPP provides critical funding from producers to increase the supply of recycled commodities by expanding diversion program access, processing infrastructure, and education and outreach programs.
- EPR for PPP legislation would provide crucial funding towards Michigan's materials management system and efforts to reach 45% diversion. An analysis by RRS determined that investments needed to build new material recovery facilities to process the additional 1.2 million tons of mixed recyclables<sup>45</sup> that would be received with the goal diversion rate could range from \$300 to \$357 million. Additionally, the cost to just process the additional recyclables would likely range from \$77 to \$120 million annually, which, without EPR for PPP, would be entirely borne by residents and businesses receiving services. These costs are substantial and cannot fully be supported by the Renew Michigan Fund.

## MINIMUM RECYCLED CONTENT REQUIREMENTS

- Minimum recycled content requirements have been enacted in nine states for newsprint and five states for items such as fiberglass, glass containers, plastic containers, and plastic trash bags. Minimum recycled content laws are considered a demand-side policy approach in that they increase the demand for recycled commodities but do not impact the collection and processing of materials. Michigan could consider minimum recycled content requirements as a method of increasing demand for recycled content by end markets.
- Any consideration of minimum recycled content laws should be coupled with EPR legislation that will provide financial support of the supply of recycled commodities for end markets to utilize. Together, EPR legislation and minimum recycled content laws provide both financial support of the materials management system as well as market stability that can further drive private investment.

## DEPOSIT RETURN SYSTEMS

- Ten states have enacted Deposit Return Systems (DRS) that cover varying types of beverage containers and deposit values. While many DRS were enacted in the 1970s and 1980s, the recent move towards policy for the management of end-of-life of materials has resulted in these systems being brought up again in legislatures across the U.S., both as potential new state legislation and modifications and expansions to existing bottle deposit systems.
- Michigan could consider an amendment to the state's DRS that expands the covered beverages to include non-carbonated beverages such as bottled water, juice, and sports drinks as these items have grown significantly in market share since Michigan's bottle bill was enacted. Another avenue Michigan could pursue is altering the reimbursement structure to retailers to include a handling fee that could support standalone redemption centers able to provide added convenience for container redemptions similar to Oregon's BottleDrop system.

## SINGLE-USE ITEM TAXES AND FEES

- Single-use item taxes and fees such as fees on carryout retail plastic and paper bags have the potential to generate revenue that can be used for litter cleanup or to support the recycling system and at the same time reduce litter pollution in waterways.
- Presently, Michigan municipalities are prohibited from banning, regulating, or imposing fees on the use of plastic bags and other containers due to legislation enacted in 2016. However, since that time, the political makeup of the state's legislature has changed, and legislation has been introduced to repeal this prohibition. If repealed, Michigan could consider enacting a single-use plastic and paper carryout bags fee that could generate revenue remitted back to local municipalities or the state. In considering such legislation, Michigan should consider potentially unintended consequences such as the uptick in the use of compostable bags, which may have deposition problems of their own.

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<sup>45</sup> Mixed recyclables refer to recyclables traditionally processed at MRFs such as mixed paper, cardboard, plastic bottles and jugs, aluminum and steel cans, and glass containers.

## ORGANICS DIVERSION POLICY

- Five states currently have either a food waste landfill ban or food waste diversion policy in place: California, Connecticut, Massachusetts, Rhode Island, and Vermont.
- In all states with an organics diversion policy in place, an ongoing challenge remains ensuring adequate processing capacity within reasonable distance to generators and sustained end markets. Many states are aware of these challenges when enacting legislation and work to address processing capacity and end market development within the policy.
- Approximately 18% of the total additional diversion needed in Michigan to reach the 45% diversion goal is food waste, so that Michigan is unlikely to reach their diversion targets without addressing food waste in the MSW stream. A potential policy pathway to addressing food waste disposal is through organics diversion policy such as a food waste landfill ban or food waste diversion requirement.

# CONCLUSION

This report highlights the progress made in Michigan towards materials management and a circular economy and away from a disposal only approach. The report also brings forth a number of areas where progress still needs to be made including:

- Recovery data tracking, especially for the commercial sector
- Equitable access to recycling programs and expansion of convenient programs for multi-family households and commercial generators
- Expansion of diversion infrastructure including MRFs and organics processing, particularly around food waste recovery.
- Investment in end market growth to support jobs and the circular economy.
- Continued project investment to help businesses and municipalities bring recycling solutions into communities.
- State-level policy that has the potential to provide long term funding and grow both the supply of and demand for recycled commodities.
- Continued funding for materials management plans with an emphasis on prevention, reuse, and recycling, to reach the state's diversion goals and elevate the role of materials management in Climate Action Planning.

Michigan's efforts and investments have already made a significant impact on the state's infrastructure, community programs and engagement, and policy to drive diversion. In the coming years Michigan is well positioned to continue this forward momentum towards circular materials management.

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# APPENDIX

## APPENDIX FOR CURRENT DISPOSAL AND RECOVERY LANDSCAPE

Table 51 shows the Michigan Council of Governments by County.

Table 51: Description of Council of Governments in Michigan

COUNTY	COG
Livingston County	1
Monroe County	1
Washtenaw County	1
Macomb County	1
Oakland County	1
St. Clair County	1
Wayne County	1
Hillsdale County	2
Jackson County	2
Lenawee County	2
Barry County	3
Branch County	3
Calhoun County	3
Kalamazoo County	3
St. Joseph County	3
Berrien County	4
Cass County	4
Van Buren County	4
Genesee County	5
Lapeer County	5
Shiawassee County	5
Clinton County	6
Eaton County	6
Ingham County	6
Gratiot County	7
Arenac County	7
Bay County	7
Clare County	7
Gladwin County	7
Huron County	7
Iosco County	7
Isabella County	7
Midland County	7
Ogemaw County	7
Roscommon County	7
Saginaw County	7
Sanilac County	7
Tuscola County	7

Ionia County	8
Kent County	8
Mecosta County	8
Montcalm County	8
Ottawa County	8
Allegan County	8
Osceola County	8
Cheboygan County	9
Oscoda County	9
Otsego County	9
Alpena County	9
Alcona County	9
Crawford County	9
Montmorency County	9
Presque Isle County	9
Antrim County	10
Benzie County	10
Charlevoix County	10
Emmet County	10
Grand Traverse County	10
Kalkaska County	10
Leelanau County	10
Manistee County	10
Missaukee County	10
Wexford County	10
Chippewa County	11
Luce County	11
Mackinac County	11
Alger County	12
Delta County	12
Dickinson County	12
Marquette County	12
Menominee County	12
Schoolcraft County	12
Baraga County	13
Gogebic County	13
Houghton County	13
Iron County	13
Keweenaw County	13
Ontonagon County	13
Lake County	14
Mason County	14
Muskegon County	14
Newaygo County	14
Oceana County	14

## APPENDIX FOR MICHIGAN COMMERCIAL “BIG BOX” RETAIL RECYCLING ESTIMATE

For reference, Table 52 provides the recycling data as reported to the OEPA for different commercial entities. The data represents the most recent reported available data for each store. Some data may have been reported in 2019, 2020, and 2021.

Table 52: Ohio Reported Commercial Retailer Recycling

COMMERCIAL RETAILER	GLASS	PLASTIC	NEWSPAPER	CARDBOARD	MIXED PAPER	NONFERROUS	FERROUS	OTHER	WOOD	COMMINGLED	TOTAL
ALDI	0	357	0	15,983	0	0	0	0	14,294	0	30,634
CVS	0	0	0	1,659	0	0	0	0	0	947	2,606
Dollar General	0	233	0	26,994	111	0	0	0	0	0	27,337
Home Depot	0	22	0	4,426	0	0	0	865	11,076	0	16,388
Kohls	0	163	0	4,309	0	7	0	84	0	0	4,562
Kroger	0	2,517	618	74,616	0	0	0	1,194	0	0	78,945
Lowe's	0	35	0	5,401	0	312	0	1,725	5,450	0	12,987
Meijer	0	2,093	0	35,100	96	0	679	2	0	0	37,970
REI	0	0	0	0	5	0	0	0	0	283	288
Sam's Club	0	291	0	12,280	31	4	0	851	3,240	0	16,698
Save-A-Lot	0	54	0	2,663	0	0	0	0	0	0	2,717
Target	0	451	0	17,059	1	328	0	0	0	196	18,034
United States Postal Service	0	204	0	600	11,216	0	0	0	0	0	12,020
Walgreens	0	0	0	386	0	0	0	0	0	189	575
Walmart	0	1,744	791	89,573	121	1,467	0	6,465	10,790	0	110,952
<b>Total</b>	<b>0</b>	<b>8,163</b>	<b>1,409</b>	<b>291,049</b>	<b>11,580</b>	<b>2,118</b>	<b>679</b>	<b>11,187</b>	<b>44,851</b>	<b>1,615</b>	<b>372,715</b>

Most recently available data for company spanning 2019 through 2021. Not all entities reported in 2020 or 2021.



Table 53 shows the number of commercial establishments in Ohio and Michigan for the retailers and USPS modeled in this memo.<sup>46</sup>

Table 53: Commercial Establishments in Ohio and Michigan

REPORTING COMMERCIAL ENTITY	NUMBER OF STORES IN OH	NUMBER OF STORES IN MI
Aldi Inc.	159	103
CVS	365	230
Dollar General Corporation	980	701
Home Depot Corporation	70	70
Kohls	59	46
Kroger	201	123
Lowe's Companies, Inc.	83	45
Meijer Corporation	51	123
REI	4	4
Sam's Club	27	23
Save-A-Lot	122	49
Target Corporate	65	54
United States Postal Service	1,144	918
Walgreens	240	213
Walmart	138	90

<sup>46</sup> Store numbers for each entity were gathered through store websites (e.g., Aldi store counts were sourced from <https://stores.aldi.us>) or store count lists accessible through web data providers (e.g., ScrapeHero or Statista).

## APPENDIX FOR MICHIGAN SCRAP METAL RECYCLING ESTIMATE

Table 54 presents the reported scrap metal recycling in Pennsylvania in 2020, broken out by residential and commercial sectors.

Table 54: Pennsylvania Reported Scrap Metal Recycling 2020

	ALUMINUM SCRAP	FERROUS METAL	NON-FERROUS METAL	COPPER	BRASS	LEAD	STAINLESS STEEL	NICKEL	WIRE/CABLE	MIXED METALS (INCLUDES DRUM STEEL)	WHITE GOODS	TOTAL
<b>Residential</b>	3,283	59,556	5,698	725	195	3,634	823	2	169	15,954	8,657	<b>98,697</b>
<b>Commercial</b>	21,878	553,950	15,242	3,208	1,381	5,368	162,199	47	20,726	147,918	19,525	<b>951,442</b>
<b>Total</b>	<b>25,162</b>	<b>613,505</b>	<b>20,940</b>	<b>3,933</b>	<b>1,576</b>	<b>9,002</b>	<b>163,022</b>	<b>49</b>	<b>20,895</b>	<b>163,873</b>	<b>28,182</b>	<b>1,050,139</b>
<b>Residential</b>	3,283	59,556	5,698	725	195	3,634	823	2	169	15,954	8,657	<b>98,697</b>

Table 55 shows the population and commercial employment data for NAICS codes 42 through 99 based on Census data. The data in Tables 6 and 7 were used to calculate the per capita and per employment recycling rates for Pennsylvania's scrap metal recycling and apply the data to Michigan.

Table 55: Population and Employment Data for Michigan and Pennsylvania

STATE	POPULATION	SOURCE
<b>Pennsylvania</b>	13,002,700	2020 Decennial Census
<b>Michigan</b>	10,077,331	2020 Decennial Census
<b>Pennsylvania</b>	4,448,096	Census County Business Patterns 2021; NAICS codes 42 - 99
<b>Michigan</b>	2,995,738	Census County Business Patterns 2021; NAICS codes 42 - 99

## APPENDIX FOR POTENTIAL RECOVERY

### MULTI-FAMILY POTENTIAL RECOVERY ESTIMATION METHODOLOGY

#### ANNUAL POUNDS PER UNIT METHODOLOGY

The estimation of the generation from multi-family households is based on a Hennepin County, MN Multi-family Waste Study (Hennepin County 2017). Annual total waste generation in Hennepin County was 1,603 pounds per multi-family unit<sup>47</sup>. The multi-family generation rates were then adjusted based on the average household size of renter-occupied units in Michigan as compared to Minnesota using US Census data<sup>48</sup> and estimated at 1,715 annual pounds per unit or 805 pounds per person. Normalizing to daily generation, Michigan multi-family households are estimated to generate 4.70 pounds per unit per day in total waste. The US EPA estimate of 4.9 pounds per person per day of total MSW generation is more than double the multi-family generation rate reported here because it includes residential and commercial generation together whereas the data presented in Table 56 isolates residential generation separate from commercial.

Table 56: Annual Pounds of Multi-family Waste Generated per Unit, by Category

CATEGORY	ANNUAL POUNDS PER UNIT ADJUSTED HENNEPIN COUNTY, MN <sup>47</sup>	ANNUAL POUNDS PER UNIT MICHIGAN	ANNUAL POUNDS PER PERSON MICHIGAN
Trash	433	463	217
Recycling	481	515	242
Organics	441	472	221
HHW and Electronics	30	32	15
Bulky Waste	117	125	59
Textiles	101	108	51
<b>Total</b>	<b>1,603</b>	<b>1,715</b>	<b>805</b>

#### TOTAL DISPOSAL AND POTENTIAL RECOVERY METHODOLOGY

The estimated annual pounds per person in multi-family units was used to model the total proportion of residential disposal coming from the multi-family sector. The 2020 US Census reported total Michigan population living in multi-family households (5 units and above) was multiplied by the annual pounds per person factor from Table 1. A major assumption of this estimate is that all waste generated in the multi-family sector is going to disposal in Michigan, however without any multi-family specific recycling data available in Michigan RRS was unable to determine potential recycling rates for multi-family households in the state.

Once total disposal was estimated for the multi-family sector, the total disposed tons from single-family residents was derived from the difference of total residential disposal estimated from fiscal year 2022 Annual Report of Solid Waste Landfilled in Michigan and the multi-family calculated total disposal<sup>49</sup>. The single-family waste generation factor was calculated at 757 pounds per person per year. The disposal generation factor for all residential generation was calculated at 766 pounds per person per year. While the data modeled here assumes that the residential stream includes single and multi-family disposal, an unknown proportion of multi-family waste is collected with the commercial stream.

<sup>47</sup> The Hennepin County multi-family generation rates were adjusted by normalizing the rates to occupied multi-family households based on the 2017 estimated US Census data for Hennepin County.

<sup>48</sup> 'Renters' is the official census designation for persons per household in multi-family.

<sup>49</sup> The Report of Solid Waste Landfilled in Michigan reports total MSW disposal in Michigan in cubic yards. RRS converts the total disposal from cubic yards to tons using 3.3 cubic yards per ton. Additionally, to estimate the proportion of disposal attributed only to the residential sector, RRS utilizes a series of waste characterization studies that estimate the proportion of residentially and commercially sourced material in the MSW disposal stream. On average 47% of the MSW stream is assumed to be residential material and 53% is commercial material.

## UPDATED DISPOSAL AND RECYCLING POTENTIAL BY SECTOR

### HOUSING DATA

Utilizing the household and population count in Michigan from the 2020 US Census, and the total disposal by COG, and the estimation of generation, RRS was able to determine the recycling potential of different sectors within Michigan by housing type.

Table 57: Breakout of Population and Household Counts by Housing Units Type in Michigan

Housing Type	Population	Households
Single-Family	7,762,882	3,105,133
Single-Family 2-4 Unit	483,880	194,825
Multi-Family 5+ Unit	1,830,569	741,802
<b>Total</b>	<b>10,077,331</b>	<b>4,041,760</b>

## APPENDIX FOR INTERVIEWED MATERIAL RECOVERY FACILITIES<sup>50</sup>

Table 58: Interviewed MRFs

MRF	ADDRESS
Emmet County Recycling	7363 Pleasantview Road, Petosky, MI 49740
Marquette County Solid Waste Management Authority	600 Co Rd NP, Marquette, MI 49855
Recycle Ann Arbor	4150 Platt Road, Ann Arbor, MI 48108
Resource Recovery and Recycling Authority of Southwest Oakland County (RRRASOC)	20000 W. 8 Mile Rd. Southfield, MI 48705
Southeastern Oakland County Resource Recovery Authority (SOCRRA)	995 Coolidge, Troy, MI 48084
Kent County's Recycling & Education Center	977 Wealthy St SW, Grand Rapids, MI 49503
WM Recycle America – Saginaw	1957 Findley Street, Saginaw, MI 48601
WM Recycle America – Grand Rapids	1737 Chicago Dr SW, Wyoming, MI 49509

<sup>50</sup> The interviewed facilities' names have been reordered and removed in data tables throughout the report to accommodate interviewee privacy requests.

## MRF INTERVIEW QUESTIONS

# NextCycle Michigan Gap Analysis MRF Research

Phone or Video Call Interview, July – Sept. 2023

### Pre-Interview Information

A. Facility	
B. Address	

### Interview Introduction

**Introduction:** The NextCycle Michigan data team is working with Michigan's Department of Environment, Great Lakes, and Energy (EGLE) to develop their annual Gap Analysis report. As part of this work, RRS is conducting interviews with Material Recovery Facilities (MRFs) throughout the State to understand current recycling operations and capacity.

Interviewee Name and Title:

Interviewee Email:

### MRF Processing Capacity, Staffing, and Equipment

**Goal of questions for 2023 Gap Analysis:** Reassess collection and processing opportunities and gaps regionally and by material. Identify new processing capacity, staffing changes, and processing equipment (e.g., eddy currents, optical sorting) that have come online, or are planned, within the state.

1. Is the facility single stream or dual stream?
2. About how much of the facility's materials are residential vs. commercial (e.g., 80% residential, 20% commercial)?
3. How many TPD or TPH is the facility designed to process?
4. How many TPD or TPH is the facility currently processing? Is the facility at, or near, capacity?
5. How many hours does the facility operate per day?
6. How many shifts does the facility operate per day?
7. In the past three years, have the facility's hours and staffing changed? If yes, answer the following questions:
  - A. Did hours increase or decrease? When and by how much?
  - B. Did the number of shifts increase or decrease? When and by how much?
  - C. How have these changes impacted TPH and throughput? Does the facility anticipate an increase or decrease in operating hours?
8. Has the facility added new processing equipment in the last three years (e.g., eddy currents, optical sorting, robotics)? If yes, answer the following questions:
  - A. What type of equipment and when?
  - B. Which materials does each piece of equipment handle?
9. Does the facility plan to add new equipment in the future? If yes, answer the following questions:
  - A. What type of equipment and when?
  - B. Which materials will each piece of equipment handle?

### MRF Residual Rates & Materials

*Goal of questions for 2023 Gap Analysis:* Identify specific materials lost in residual streams, such as film and polypropylene, due to gaps such as limited sorting capacity and lack of end markets.

10. **What is the facility's residual rate?**
  - A. Has the facility's residual rate notably increased or decreased in the past three years? If so, why and by how much?
11. **Has the facility completed a residue composition study?**
  - A. If yes, can you share the study and/or the results?
12. **What are the most prevalent materials seen in the facility's residue?**
  - A. Are these accepted or unaccepted materials?
    - I. If these materials are accepted, what is the reason they are ending up in residue (e.g., end-market access, equipment or labor needs, material quality, etc.)?

### **Collection and Processing Capacity & End Market Infrastructure for Specific Materials**

*Goal of questions for 2023 Gap Analysis:* Explore main avenues and strategies for current and increased collection, processing capacity, and recovery for emerging material markets (e.g., film, PP, textiles, glass). Identify end market opportunities and gaps.

13. **Does the facility collect and process films? If so, please answer the following questions.**
  - A. **Which films does the facility accept?**
    - I. How are these films collected (e.g., source-separated, single stream)?
    - II. What is the estimated throughput for each film type?
  - B. How are films processed in the facility?
  - C. What current or emerging markets exist for these materials?
14. **If films are not accepted, what would the facility need to accept and process these materials?**
15. **Does the facility collect and process polypropylene (PP)? If so, please answer the following questions.**
  - A. How is PP collected (e.g., source-separated, single stream)?
    - I. If collected or marketed separately, what is the estimated throughput for PP?
  - B. How is PP processed in the facility?
  - C. What current or emerging markets exist for these materials?
16. **If PP is not accepted, what would the facility need to accept and process this material?**
17. **Does the facility collect and process textiles? If so, please answer the following questions.**
  - A. How are textiles collected (e.g., source-separated, single stream)?
    - I. If collected separately, what is the estimated throughput for textiles?
  - B. How are textiles processed in the facility?
  - C. What current or emerging markets exist for these materials?
18. **If textiles are not accepted, what would the facility need to accept and process this material?**
19. **Does the facility collect and process glass? If so, please answer the following questions.**
  - A. How is glass collected (e.g., source-separated, single stream)?
    - I. If collected or marketed separately, what is the estimated throughput for glass?
  - B. How is glass processed in the facility?
  - C. What current or emerging markets exist for these materials?
20. **If glass is not accepted, what would the facility need to accept and process this material?**

## APPENDIX FOR DIVERSION PROGRAM ACCESS

### RECYCLING ACCESS BARRIERS

Table 59 shows the average U.S. Census tract median household income and corresponding MiEJScore by quartile. MiEJScore's range from 0 indicating the lowest environmental hazards to 100 indicating the highest environmental hazardous. As average median income increases, the MiEJScore decreases.

Table 59: Average Median Income and MiEJScore Broken Down by Quartile

QUARTILE	AVERAGE TRACT MEDIAN HOUSEHOLD INCOME	MIEJSORE
1	\$30,378	76
2	\$48,047	48
3	\$62,602	43
4	\$96,711	34

### FOOD WASTE DROP-OFF SITE AND HAULERS

Table 60: Food Waste Drop-Off Sites

FACILITY NAME	ADDRESS	CITY
Bay City Recycles	2900 North Water Street	Bay City
Coopersville Environmental Sustainability Center	15600 68th Ave	Coopersville
Emmet County Farmers Market	Howard St.	Petoskey
Felch Township Waste Transfer Station	4243 M-69	Felch
Ferndale Residential Drop off	1198 Earle Blvd	Ferndale
Ferndale Residential Drop off	1615 E Lewiston Ave	Ferndale
Ferndale Residential Drop off	1280 Hilton Rd	Ferndale
Ferndale Residential Drop off	1201 Livernois St	Ferndale
Ferndale Residential Drop off	159 Withington St	Ferndale
Georgetown Environmental Sustainability Center	6693 Roger Drive	Jenison
Grand Haven Environmental Sustainability Center	16850 Comstock Avenue Suite B	Grand Haven
Holland Environmental Sustainability Center	14053 Quincy St	Holland
Krull's Composting	857 W Burdickville Road	Maple City
Marquette County Landfill	600 County Road NP	Marquette
Michiana Recycling and Disposal Company	33541 Reum Road	Niles
Spurt Industries - Wixom	2041 Charms Rd	Wixom
Tuthill Farms and Composting, Inc.	10505 Tuthill Rd.	South Lyon
Wormies Drop-Off	1220 Kalamazoo Ave SE	Grand Rapids

Table 61: Food Waste Haulers

FOOD WASTE HAULERS	
Ann Arbor Municipal	My Green Michigan
BARC	New Soil
Carters Compost	Organicycle
CoSustainability	Partridge Creek Farms (Future Food Waste Hauler)
Eastside Compost Company	Scrap Soils
Emmet County	Turtle Ridge Compost
Iris Waste Specialists	Unlimited Recycling
Midtown Composting	Wormies



## APPENDIX FOR PROCESSING INFRASTRUCTURE

Table 62 and 63 provide the background information needed to understand RRS' hemp waste generation rate for 2022. Table 62 shows the baseline source information and Table 64 provides the calculated waste estimates.

Table 62: Data Table for Hemp Waste Estimate

CATEGORY	MI HEMP MARKET <sup>51</sup>	AVERAGE YIELD (LBS./ACRE) <sup>52</sup>	AVERAGE WASTE (LBS./ACRE) <sup>52</sup>
Flower	64%	1,235	6,027
Grain	3%	530	6,732
Fiber	6%	2,620	4,642
Seed	16%	530	6,732
Other	11%	1,229	6,033

Table 63: Modeled Hemp Waste in Michigan

YEAR	TOTAL ACRES PLANTED IN MI	FLOWER WASTE (TONS)	GRAIN WASTE (TONS)	FIBER WASTE (TONS)	SEED WASTE (TONS)	OTHER WASTE (TONS)	TOTAL WASTE (TONS)
2019	3,689	7,115	373	514	1,987	1,224	11,212
2020	2,340	4,513	236	326	1,260	777	7,112
2021	2,284	4,405	231	318	1,230	758	6,942
2022	225	434	23	31	121	75	684

<sup>51</sup> The data for the MI hemp market was sourced from <https://hempindustrydaily.com/chart-michigan-to-increase-2020-hemp-production-but-53-of-2019-crop-is-still-unsold/>

<sup>52</sup> The data for average yield and waste is sourced from <https://hempindustrydaily.com/behind-the-numbers-what-usdas-1st-hemp-survey-shows-about-the-industry/> and <https://www.nass.usda.gov/Newsroom/2022/02-17-2022.php>

## APPENDIX FOR END MARKETS

Table 64 presents a list of potential end market companies. End markets in this report is a broad term that includes processors and brokers because there are differences in markets for different commodities.

Table 64: List of Potential End Markets in Michigan

COMPANY NAME	ADDRESS	CITY	MATERIAL
ERG Environmental	13040 Merriman, Suite 200	Livonia	Batteries
GLR Advanced Recycling (GLR Recycling Solutions)	30835 Groesbeck Hwy	Roseville	Electronics
eRecycle TC	466 N US 31 S	Traverse City	Electronics
Glass Recyclers Dearborn	6465 Wyoming Street	Dearborn	Glass
Holcim Alpena Cement Plant	1435 Ford Ave	Alpena	Glass
Knauf Insulation Albion	1000 E North Street	Albion	Glass
Schupan & Sons	2619 Miller Rd	Kalamazoo	Glass
BARC - Kaleva	14407 Industrial Dr	Kaleva	HHW <sup>53</sup>
Battery Solutions	4930 Holtz Dr	Wixom	HHW
CM Rubber Recycling - Coleman	4602 W Saginaw Road	Coleman	HHW
Environmental Rubber Recycling	6515 Dort Hwy	Flint	HHW
ePaint Recycling	551 W Michigan Ave	Battle Creek	HHW
A & L Iron and Metal - Gaylord	2000 Milbocker Rd	Gaylord	Metal
A C Foundry	1146 Raymond Rd N	Battle Creek	Metal
Acme Warren	2565 John B Ave	Warren	Metal
Acra Cast Bay City	1837 1st St	Bay City	Metal
AK Steel Dearborn Works	4001 Miller Rd	Dearborn	Metal
AlcoTec Wire Traverse City	2750 Aero Park Drive	Traverse City	Metal
Algonac -Clay	Algonac Cast Products, Inc.	Clay	Metal
Aludyne - Alma Operations	250 Adams St	Alma	Metal
Aludyne Howell	2280 W Grand River Ave	Howell	Metal
Angstrom Aluminum Castings Grand Rapids	3559 Kraft Ave Se	Grand Rapids	Metal
Ashland Aluminum Fowlerville	200 Veterans Drive	Fowlerville	Metal
Auma Engineered Products Wixom	47140 Cartier Dr	Wixom	Metal
AUTOCAST Grandville	4565 Spartan Industrial Dr SW	Grandville	Metal
Benteler Aluminum Systems Holland	533 Ottawa Avenue	Holland	Metal
Bernier Cast Metals Saginaw	2626 Hess Ave	Saginaw	Metal
Bonnell Aluminum Niles	2005 Mayflower Road	Niles	Metal
Brass Aluminum Forging Ferndale	965 Wanda Street	Ferndale	Metal
Brazeway Adrian	2711 E. Maumee Street	Adrian	Metal

<sup>53</sup> HHW refers to hazardous household waste.

COMPANY NAME	ADDRESS	CITY	MATERIAL
Busche Fruitport	14638 Apple Dr	Fruitport	Metal
Carhart Products	460 Main Street	Saranac	Metal
Cascade Die Casting Grand Rapids	7441 Division Ave S A1	Grand Rapids	Metal
Cascade Die Casting Sparta	9983 Sparta Ave NW	Sparta	Metal
Centracore Saint Clair	315 Whiting St	Saint Clair	Metal
Century Muskegon	339 W Hovey Ave	Muskegon	Metal
CH Crane & Associates Saint Clair Shores	200 Maple Park Blvd #203	Saint Clair Shores	Metal
Chassis Southfield	300 Galleria Officentre # 501	Southfield	Metal
Chassis Stevensville	2800 Yasdick Dr	Stevensville	Metal
City Aluminum Foundry Waterford	2505 Williams Dr	Waterford	Metal
Continental Aluminum - New Hudson	29201 Milford Rd	New Hudson	Metal
Cooper Kalamazoo	8216 Douglas Ave	Kalamazoo	Metal
Dundee Castings Dundee	500 Ypsilanti St	Dundee	Metal
Eagle Muskegon	2134 Northwoods Ave	Muskegon	Metal
Eps Ferrysburg	585 Second St	Ferrysburg	Metal
Erbsloeh Aluminum Solutions Portage	6565 S Sprinkle Rd.	Portage	Metal
Extruded Aluminum Belding	7200 Industrial Dr	Belding	Metal
Ford Motor Company - Dearborn	21500 Oakwood Blvd	Dearborn	Metal
G & F Prototype Plaster Fraser	33670 Riviera	Fraser	Metal
G M Bassett Pattern Farmington Hills	31162 W 8 Mile Rd	Farmington Hills	Metal
G M Brass & Aluminum Foundry Benton Harbor	200 W Wall St	Benton Harbor	Metal
Gerdau - Jackson	5591 Morrill Rd	Jackson	Metal
Gerdau - Monroe	3000 E Front St	Monroe	Metal
GLR Solutions	31475 Utica Rd	Fraser	Metal
GM Powertrain Corp Saginaw Metalcasting Operations	1629 N Washington Ave	Saginaw	Metal
Great Lakes Die Cast Henry Muskegon	1940 Henry St	Muskegon	Metal
Great Lakes Die Cast Laketon Muskegon	701 W Laketon Ave	Muskegon	Metal
Hackett Brass Foundry Detroit	1200 Lillibridge St	Detroit	Metal
Hanson Mold Saint Joseph	3500 Hollywood Rd	Saint Joseph	Metal
Hobart Filler Metals Traverse City	1631 International Drive	Traverse City	Metal
Hoffmann Saint Joseph	229 Kerth St	Saint Joseph	Metal
Homestead Tool & Machine Coleman	2618 Coolidge Rd	Coleman	Metal
Huron Valley Steel - Trenton	1745 Fritz Dr	Trenton	Metal

COMPANY NAME	ADDRESS	CITY	MATERIAL
Hydro Aluminum - Cassopolis	1475 Follett Drive	Cassopolis	Metal
International Extrusions	32416 Industrial Rd	Garden City	Metal
International Extrusions	5800 Venoy Road	Garden City	Metal
International Extrusions	39001 Schoolcraft Rd	Livonia	Metal
J & I Technology Troy	1850 Thunderbird	Troy	Metal
J & M Norton Shores	1821 Manor Dr	Norton Shores	Metal
Kaiser Kalamazoo	5205 Kaiser Drive	Kalamazoo	Metal
Kaiser Midlink Kalamazoo	2505 Midlink Dr	Kalamazoo	Metal
Key Casting Sawyer	13145 Red Arrow Hwy	Sawyer	Metal
Lakeshore Die Cast Baroda	8829 Stevensville Baroda Rd	Baroda	Metal
Light Metals Wyoming	2740 Prairie Street SW	Wyoming	Metal
Lincoln Park Die & Tool Company Brownstown	18325 Dix Toledo Hwy	Brownstown	Metal
Line Precision Farmington Hills	31666 W 8 Mile Rd	Farmington Hills	Metal
MAC - Detroit	17385 Ryan Rd	Hamtramck	Metal
Machine Craft Roseville	15212 Common Rd	Roseville	Metal
Mag-TEC Casting Jackson	2411 Research Dr	Jackson	Metal
Mall City Kalamazoo	850 E Crosstown Pkwy	Kalamazoo	Metal
Max Casting Benton Harbor	116 Paw Paw Ave	Benton Harbor	Metal
Metal Technologies Three Rivers Gray Iron	429 4th St	Three Rivers	Metal
Michigan Die Casting Dowagiac	51241 M 51 N	Dowagiac	Metal
Michigan Extruded Aluminum Jackson	205 Watts Road	Jackson	Metal
Michigan Wheel Marine Grand Rapids	1501 Buchanan Ave SW	Grand Rapids	Metal
Milan Cast Metal Milan	13905 N Sanford Rd	Milan	Metal
MOST - Troy	36555 Corporate Dr #350	Farmington Hills	Metal
Mueller Industries Port Huron Lapeer	2409 Lapeer Ave.	Port Huron	Metal
Mueller Industries Port Huron Willis	2409 Wills St	Port Huron	Metal
New Products Corp Benton Harbor	448 N Shore Dr	Benton Harbor	Metal
Non-Ferrous Cast Alloys Norton Shores	1146 N Gateway Blvd	Norton Shores	Metal
North Lapeer Recycling	5700 N Lapeer Rd	North Branch	Metal
North Shore Coloma	4706 M 63 N	Coloma	Metal
Northwest Pattern Farmington Hills	29473 Medbury St	Farmington Hills	Metal
Padnos - Grand Rapids	2125 Turner Ave NW	Grand Rapids	Metal
Paragon Metals Hillsdale	3010 Mechanic Rd	Hillsdale	Metal
Parker Tooling & Design Grand Rapids	2563 3 Mile Rd NW	Grand Rapids	Metal

COMPANY NAME	ADDRESS	CITY	MATERIAL
Plascore Zeeland Fairview	615 N Fairview Rd	Zeeland	Metal
Plascore Zeeland Roosevelt	581 E Roosevelt Ave	Zeeland	Metal
Port City Group Muskegon	1985 E Laketon Ave	Muskegon	Metal
Postle Cassopolis	201 N Edwards St	Cassopolis	Metal
Precious Metal Inventory Management - Detroit		Detroit	Metal
Prototype Shelby Township	51752 Danview Technology Ct	Shelby Township	Metal
Quality Castings Kalamazoo	903 Hotop Ave	Kalamazoo	Metal
Quality Non-ferrous Foundry Wyoming	1251 Judd SW	Wyoming	Metal
Real Alloy Coldwater	368 W Garfield Ave	Coldwater	Metal
Real Alloy Coldwater South	275 N Fillmore Rd	Coldwater	Metal
Richmond Steel Chesterfield	50570 E Russell Schmidt Blvd	Chesterfield	Metal
RLM Industries Oxford	100 Hummer Lake Rd	Oxford	Metal
Shawnee Specialties Eau Claire	7100 3rd St	Eau Claire	Metal
SHELLCAST Montague	5230 Industrial Park Rd	Montague	Metal
Shiloh Industries Alma	250 Adams St	Alma,	Metal
Superior Brass & Aluminum Casting East Lansing	4893 Dawn Ave	East Lansing	Metal
Superior Extrusion Gwinn	118 Avenue G	Gwinn	Metal
Supreme Casting Stevensville	3389 W Linco Rd	Stevensville	Metal
TAC MFG Jackson	4111 County Farm Rd	Jackson	Metal
Thumb Auto Core	1645 Press Rd	Caro	Metal
Tooling & Equipment Livonia	12550 Tech Center Dr	Livonia	Metal
Tri-State Aluminum LLC Muskegon	1060 E Keating Ave	Muskegon	Metal
Tri-State Cast Technologies Boyne City	926 N Lake St	Boyne City	Metal
Tru Die Cast New Troy	13066 California Rd	New Troy	Metal
Tubelite Reed City	4878 South Mackinaw Trail	Reed City	Metal
UACJ Automotive Whitehall Ludington	5175 W. Sixth Street	Ludington	Metal
Ultimate Casting & Machine West Branch	3977 S M 30	West Branch	Metal
Warner Brothers Foundry Roseville	29955 Groesbeck Hwy	Roseville	Metal
Weldaloy Products Warren	24011 Hoover Drive	Warren	Metal
White Cloud Manufacturing White Cloud	100 N Charles St	White Cloud	Metal
WIL-KAST Grand Rapids	8025 Division Ave S	Grand Rapids	Metal
Wolverine Bronze Roseville	28178 Hayes Rd	Roseville	Metal
Wolverine Die Cast Warren Hoover	22752 Hoover Rd	Warren	Metal
Wolverine Die Cast Warren Nagel	22550 Nagel St	Warren	Metal

COMPANY NAME	ADDRESS	CITY	MATERIAL
SDI OmniSource - Adrian	815 Treat St	Adrian	Metal, Electronics
SDI OmniSource - Bay City	1414 N Madison Ave	Bay City	Metal, Electronics
SDI OmniSource - Jackson	711 Lewis St	Jackson	Metal, Electronics
SDI OmniSource - Jonesville	751 Beck St	Jonesville	Metal, Electronics
SDI OmniSource - River Rouge	400 East Great Lakes St	River Rouge	Metal, Electronics
SDI OmniSource - Sturgis	2160 S Centerville Rd	Sturgis	Metal, Electronics
AJ Recycling Solutions	237 Graham Rd	Imlay City	Metal, Paper, Plastic
Grand Rapids Iron & Metal	1701 Clyde Park SW #15	Wyoming	Metal, Paper, Plastic
Padnos - Holland	117 W 7th St	Holland	Metal, Paper, Plastic, Universal
Crystal Clean	10055 Hercules Rd	Freeland	Motor oil
Evergreen Grease Service - Adrian	1445 Enterprise Dr	Adrian	Organics
ReConserve of Michigan, Inc.	170 Angell Street	Battle Creek	Organics
Cleanlites Recycling - Mason	665 Hull Rd	Mason	Other
BPV Environmental	511 76th Street SW	Byron Center	Paper
French Paper - Niles	100 French Street	Niles	Paper
GPI Kalamazoo	1819 N Pitcher St	Kalamazoo	Paper
Krell Paper Stock - Grand Rapids	580 Burton St SW	Grand Rapids	Paper
Neenah Paper - Munising	501 E Munising Ave	Munising	Paper
Nu-Wool - Jenison	2472 Port Sheldon St	Jenison	Paper
OX Engineered Products - Constantine	700 Centerville Rd	Constantine	Paper
OX Industries - White Pigeon Paper Co	15781 River Street	White Pigeon	Paper
PCA - Filer City Mill	2246 Udell St	Filer City	Paper
Resolute Forest Products - Menominee	701 4th Avenue	Menominee	Paper
River Valley Paper North	2115 Palmer Ave	Kalamazoo	Paper
UP Paper - Manistique	402 West Elk Street	Manistique	Paper
USG Corp - Otsego Mill	320 N Farmer St	Otsego	Paper
WestRock Battle Creek	177 Angell St	Battle Creek	Paper
Metro Recycling Solutions	1912 Sherwood St	Sylvan Lake	Paper, Plastic
ACI Plastics - Flint (First Facility)	2945 Davison Rd	Flint	Plastic
ACI Plastics Inc - Flint (2023 New Build)	2000 Bagwell St	Flint	Plastic
Alloy Exchange - Rockford	300 Rockford Park Dr NE	Rockford	Plastic
Bata Plastics - Grand Rapids	1001 40th St SE	Grand Rapids	Plastic
Clean Tech - Dundee	500 Dunham St	Dundee	Plastic
Dart Container Corporation	432 Hogsback Road	Mason	Plastic
Destiny Plastics - Deckerville	2121 Stoutenberg St	Deckerville	Plastic

COMPANY NAME	ADDRESS	CITY	MATERIAL
Dr. Shrink, Inc.	315 Washington Street	Manistee	Plastic
East Jordan Plastics - Beaverton	4378 M-18	Beaverton	Plastic
East Jordan Plastics - East Jordan	6400 M-32 Highway	East Jordan	Plastic
East Jordan Plastics - South Haven	1600 Stieve Dr	South Haven	Plastic
Franklin Plastics Battle Creek	1525 Hill Brady Rd	Battle Creek	Plastic
General Mill Supply - Wixom	50690 General Mill Rd	Wixom	Plastic
Industrial Resin Recycling - Howell	1480 Grand Oaks Dr	Howell	Plastic
McDunnough - Fenton	340 N Fenway Dr	Fenton	Plastic
Midland Compounding & Consulting - Midland	3180 James Savae Rd	Midland	Plastic
Padnos - Wyoming	500 44th Street SW	Wyoming	Plastic
Petoskey Plastics - Petoskey	4226 US 31 South	Petoskey	Plastic
PFA Recycling - New Baltimore	50150 E Russell Schmidt Blvd #2443	New Baltimore	Plastic
Scrap Masters - Manchester	500 W Madison St	Manchester	Plastic
TABB Packaging Solutions - Plymouth	41605 Ann Arbor Rd E	Plymouth	Plastic
United Plastics - Flint	1227 Garfield Ave	Flint	Plastic
UpCycle Polymers - Howell	1145 Sutton St, Suite B	Howell	Plastic
Vantage Plastics	1415 W. Cedar Street	Standish	Plastic
WMC - Greenville	1300 Moore St	Greenville	Plastic
Harbor Springs Excavating	1084 McBride Park Drive	Harbor Springs	Rubble
American Textile Recycling Service	209 W. Monroe St.	Jackson	Textiles
Purple Heart	953 Manufacturers Dr	Westland	Textiles
Comprenew	629 Ionia Ave SW	Grand Rapids	Universal Waste
Fryman's Recycling	300 E Railroad St	Dowagiac	Vinyl Siding

Table 65: List of 2023 Boat Wrap Drop-Off Sites

COMPANY NAME	ADDRESS	CITY
Northshore Dock & Marine LLC	13948 Blue Water Dr	Kewadin
Safe Harbor Grand Isle	1 Grand Isle Dr	Grand Haven
EMS Boat Storage	9375 11 Mile Rd	Mecosta
Monroe Boat Club	7932 Bolles Harbor Dr	Monroe
Safe Harbor Tower Marine	216 St Peters Dr	Douglas
Biz Aid, LLC Recycling	90 Darling Dr	Coldwater
Bay Area Recycling for Charities	14407 Industrial Dr	Kaleva
Bay Area Recycling for Charities	466 US-31	Traverse City
Emmet County Recycling, Composting and Waste Transfer Station	7363 Pleasantview Rd	Harbor Springs
West Basin Marina	273 Marina Dr	St Joseph
Twin Lakes Marina	2460 Fleming Rd	Lewiston
Snug Harbor Marina	616 S Hancock St	Pentwater
Leaders RPM	8500 W Main St	Kalamazoo
RB Marine Services	6771 Enterprise Dr	Douglas
Klines Resort	22260 Kline's Resort Rd	Three Rivers
Oakland Shrinkwrap LLC	Enterprise Dr	Highland Charter Twp
Missaukee County Recycling Center	6240 W Sanborn Rd	Lake City
Antrim Conservation District	4820 Stover Rd	Bellaire
Base Lake	7778 Base Lake Dr	Dexter
Ellenwoods Landing	8570 Water St	Montague
Big Whitefish Lake Association	2453 Dagget Rd	Pierson
High's Marine	409 E Delaware St	Decatur
Safe Harbor Great Lakes	1920 Lakeshore Dr	Muskegon
Lakeshore Motor Sports and Marine	4690 US-10	Ludington
Sunfield Recycling Center	1045 Independence Blvd	Charlotte