SCS ENGINEERS






Zero Waste Initiatives for Prince George's County, Maryland

Department of the Environment
Office of the Director
1801 McCormick Drive, Suite 500
Largo, Maryland 20774

Prepared by:

SCS ENGINEERS
11260 Roger Bacon Drive
Suite 300
Reston, VA 20190
(703) 471-6150

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Acronyms

C&D	Construction and Demolition Debris
CY	Calendar Year
EPA	Environmental Protection Agency
FY	Fiscal Year
HDPE	High Density Polyethylene
HHW	Household Hazardous Waste
MRF	Material Recovery Facility
MSW	Municipal Solid Waste
OCC	Old Corrugated Cardboard, or Containers
ONP	Old Newspapers
PET	Polyethylene Terepthalate (plastic beverage bottles)
PP	Polypropylene
RCRA	Resource Conservation and Recovery Act
SWMP	Solid Waste Management Plan
TPY	Tons per year
UW	Universal Waste

ACKNOWLEDGEMENTS

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- Prince George's Sierra Club Group
- Town of University Park
- Waste Zero
- Zero Waste Prince George's

1 INTRODUCTION

This document has been developed as the first step to achieving zero waste in Prince George's County and hence presents initiatives that can reduce the quantity of waste generated and/or divert waste away from landfill disposal toward reuse, recycling, and composting opportunities. The policies, programs, and services selected by the County for implementation will be evaluated, costed, and prioritized in the County's forthcoming Resource Recovery Plan.

WHAT IS ZERO WASTE?

Zero waste is an ambitious, long-term goal to nearly eliminate the need for disposal of solid waste. Zero waste is not a literal goal; we will always have some materials that cannot be recycled and cannot be designed out of the system. However, the vision of zero waste is to get as close as possible to zero disposal.

Zero waste goals cannot be achieved through a single policy. Achieving them requires a combination of sustainable practices such as product and packaging redesign, product stewardship, waste reduction, reuse, recycling, composting, and the latest technologies of recovering materials for their highest and best uses. Striving toward zero waste requires a comprehensive approach to solid waste management. It employs policy, program, educational, and technical solutions to managing wastes generated.

Addressing zero waste involves a change in perspective, rethinking the notion that generating waste is inevitable and instead mirroring natural cycles where all outputs are used as inputs to another process. Zero waste encompasses the full life-cycle of the products and materials we use every day. It includes the product design; manufacturing; distribution; and the use, reuse, and recycling of materials. This means everyone – consumers, manufacturers, governments, and businesses – has an important role in facilitating zero waste.

WHY IS ZERO WASTE IMPORTANT FOR PRINCE GEORGE'S COUNTY?

In developing and supporting policies and programs that minimize waste, Prince George's County will reduce waste generation and maximize diversion of waste from the landfill through increased reuse, recycling, and composting.

In 2015, the County generated about 1.54 million tons of waste: 816,249 tons of municipal solid waste (MSW) and 703,555 tons of construction and demolition debris (C&D) and other waste (scrap metal, land clearing debris, and recycled fluids). The County-owned Brown Station Road Sanitary Landfill is the only facility in the County accepting municipal solid waste (MSW) for disposal. Most C&D waste is managed through private disposal and recycling facilities; however, C&D waste delivered by residents of Prince George's County is accepted at the landfill. Recycling of MSW is done by both privately- and county-managed facilities. In 2015, about 60 percent of both C&D and MSW was recycled in these facilities.

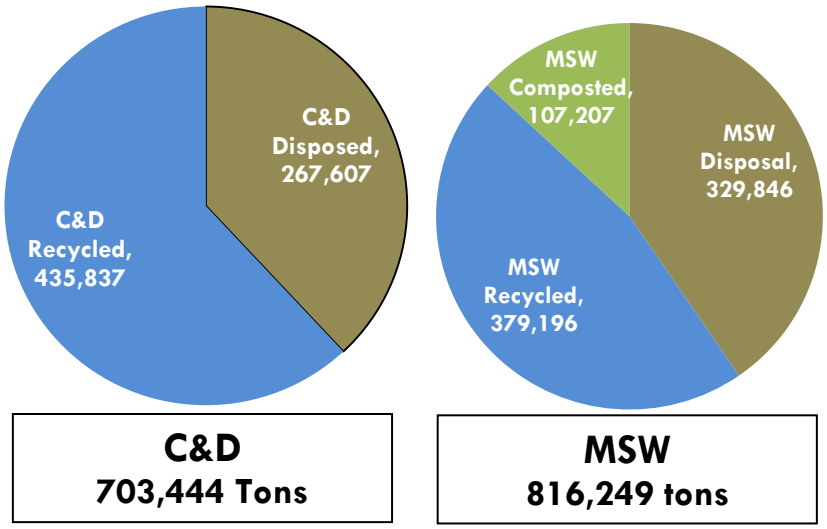
Although the County has been successful in diverting materials for recycling, there are still opportunities to recover more materials. Prince George's County's recycling rate for MSW

increased to 59.59 percent in 2015. A waste characterization study completed by the County in 2015-2016 estimated that about 75 percent of the MSW disposed of at the landfill could be diverted for reuse, recycling, and composting. It remains important to target these materials for diversion as the landfill is expected to reach capacity and close in 2028.

Exhibit 1 details the distribution of waste generated in the County in 2015. Over half of MSW and C&D waste generated in the County was recycled. The landfill accepted 275,680 tons of MSW for disposal, the majority of which was generated by the residential sector (208,000 tons). The County is responsible for the collection and disposal of most of the residential waste stream in the unincorporated area of the County through managing materials at the landfill and the County-owned materials recovery facility (MRF),[1] where materials are recycled. This positions the County to consider adopting policies with the potential to increase substantially the amount of materials diverted.

Businesses must contract with a private hauler for waste collection services. About 58,000 tons of MSW generated by the commercial sector was disposed of at the County landfill. The Maryland Department of the Environment estimates about 54,000 tons of commercial waste was disposed of at facilities outside of the County.

Exhibit 1. Waste Generation by Type in 2015



The County manages almost all of the residential MSW generated in the county, about half of the commercial MSW generated in the county, but very little of the C&D waste generated. C&D disposal and recycling and commercial waste collection and recycling is directed by businesses through contract with private haulers and facilities.

[1] Municipalities manage the collection and disposal of material from their residents and can choose where the material is disposed; however, most municipalities are utilizing the County's facilities.

IMPORTANCE OF ZERO WASTE

Moving towards zero waste has a number of important impacts on the County, its residents, and its businesses, particularly in terms of the unprecedented impact on the County's economy. The value of recyclable paper and containers disposed of at the landfill is estimated to be over $9.7 million annually (see **Table 10**). Recovering these materials as well as compostable and divertible materials from the waste stream and placing them back into the economy will have a significant impact on local revenue, job creation, and business expansion.

Minimizing waste will have an obvious and positive impact on the environment. The more we reduce, reuse, recycle, and recover materials from our waste stream, the fewer virgin raw materials will be needed in order to produce more products and packaging. This in turn reduces the amount of energy consumed and greenhouse gases produced at the beginning of a product's life-cycle. Using EPA's Waste Reduction Model (WARM)[2], SCS Engineers calculated over 66,000 metric tons of carbon equivalents (MTCE) would be reduced by recycling the following materials currently disposed at the landfill (annual quantities estimated from the 2015 Waste Characterization Study and presented in **Table 7**):

- Vegetative Food (31,600 tons)
- Corrugated Cardboard (15,000 tons)
- Office Paper/Junk Mail (16,300 tons)
- Non-Vegetative Food (13,100 tons)
- Mixed Plastics (10,600 tons)
- Glass Bottles/Jars (9,300 tons)
- Newspaper/print (7,000 tons)
- Leaves (6,600 tons)
- Brush (6,000 tons)
- PET Plastic #1 Bottles (5,700 tons)
- Carpet/Carpet Padding (3,700)
- Grass (4,200 tons)
- Pallets/Lumber (3,600 tons)
- Magazines/Catalogs/Other Books (3,300 tons)
- HDPE Plastic #2 Bottles (2,900 tons)
- Ferrous Cans (2,700 tons)
- Aluminum Cans/Foil (2,500 tons)

Recycling these materials could be the equivalent to:

- Removing the annual emissions from over 55,000 passenger vehicles; or
- Conserving nearly 30 million gallons of gasoline; or
- Conserving over 1,400 railcars of coal; or
- Conserving nearly 11 million cylinders of propane used for home barbeques.

WHAT ARE ZERO WASTE GOALS?

The Maryland Department of the Environment (MDE) established zero waste goals as part of its legislatively mandated Green House Gas Reduction Plan. These goals are to strive to achieve long-term recycling and waste diversion rates of 80% and 85%, respectively, by 2040. Other jurisdictions across the country have established zero waste goals which are presented in **Table 1**.

[2] U.S. EPA Waste Reduction model (WARM), Version 13, accessed via http://www.epa.gov/warm. There are other models for estimating carbon reductions through recycling that may show different results.

The County is in the process of establishing its zero waste goals. In developing policies, programs and infrastructure to achieve zero waste, the County can both maximize diversion from landfills and reduce generation of waste. Achieving zero waste entails encouraging the County, its residents, businesses, and visitors to reevaluate what is considered waste.

Table 1. Zero Waste Goals of Other Jurisdictions

Jurisdiction (Year Zero Waste Policy Adopted)	Population	Waste Diversion Goal by Year				
		2015	2020	2025	2030	2040
State of Maryland (2014)	5.8 million	54%	65%	70%	75%	85%
New York City, NY (2018)	8.2 million	-	-	-	90%	-
City of San Jose, CA (2008)	952,560	-	-	100%	-	-
City of Austin, TX (2008)	811,458	-	75%	-	-	90%
City of San Francisco, CA (2002)	805,235	-	100%	-	-	-
Boulder County, CO (2010)	294,567	-	-	100%	-	-
City of Pasadena, CA (2014)	137,122	-	-	-	-	87%
City of Fort Collins, CO (2013)	143,986	-	75%	90%	100%	-
Logan County, OH (2007)	45,858		100%		-	-
Teton County, WY (2014)	21,294	-	-		60%	-

*U.S. Census Bureau; 2010 population; www.census.gov

To achieve the State's goal of 85 percent waste diversion by the year 2040 would require the County to maintain current levels of recycling and diversion and recycle and divert additional amounts of waste.

Achieving these levels of diversion would require considerable time and investment and the right mix of policies and programs. Implementing policies to facilitate reusing, recycling, and diversion are required to divert construction and demolition debris and "other" waste as these materials are not disposed of at the County's landfill and are controlled by private waste management companies

HOW IS THIS DOCUMENT STRUCTURED?

There are four main sections of this document:

- **Section 1: Introduction** - Describes what zero waste is and why it is important to the County
- **Section 2: Existing Waste Management System and Current Conditions** - Describes the current and complex waste management system in place.

- **Section 3: Zero Waste Initiatives** – Describes strategies that could be used by the County to achieve zero waste.

- **Section 4: Next Steps** – Describes where the County goes from here on the quest for zero waste.

2 EXISTING WASTE MANAGEMENT SYSTEM AND CURRENT CONDITIONS

Prince George's County is an urbanized County with densely populated areas as well as rural areas. The County is about 485 square miles, located directly east of Washington, DC, and contains 27 incorporated municipalities as well as unincorporated areas. The population of Prince George's County was about 863,420 in 2010, which represented a seven percent increase over 2000[3]. The Metropolitan Washington Council of Governments forecasts the population of the County will grow by about 15 percent between 2010 and 2040. Coupled with the population growth is an estimated 25 percent increase in the number of households in the County during that same time[2]. This growth will have an economic and environmental impact on the County's solid waste management systems.

SOLID WASTE FACILITIES

There are a number of solid waste facilities located throughout Prince Georges County. These facilities serve the citizens of the County for the management of many different types of solid waste. Prince George's County presently relies on the landfill as the primary disposal site for solid waste. Materials prohibited from burial at the landfill include vegetative yard waste, household hazardous waste, medical waste, liquids, animal carcasses used in research, and automobiles. The landfill also houses a drop-off area where residents may bring electronics, tires, household hazardous waste, and recyclables collected by the County curbside program. These materials are properly managed and transported to other sites for disposal or recycling. The County prefers that residents take yard trimmings directly to the Western Branch Composting Facility; however, the landfill will accept yard trimmings delivered by residents and transport it to Western Branch for composting. **Table 2** summarizes the permitted solid waste acceptance facilities operating in the County. Additional details and mapped locations of these facilities can be found in the Ten Year Solid Waste Management Plan.

WASTE COLLECTION

The County maintains some control over the collection and disposal of municipal solid waste (MSW) by executing contracts and licensing haulers to operate within the County. All solid waste and recycling vehicles operating in the County must obtain a license and permit from the Department of the Environment. The County contracts with several private haulers for curbside refuse collection from approximately 162,000 households. Municipalities within the County manage the curbside collection of refuse from about 87,600 households.

By contracting with these haulers for collection of residential waste the County can stipulate in their contracts that waste collected must be disposed of at the County landfill. Contracting and licensing waste haulers to operate and collect waste ensures that collection methods are consistent across the County. It also facilitates competition among waste haulers to provide quality service at a reasonable price for the County's residents. The 2016 solid waste collection fee for once per week curbside collection of refuse is $240.66 per household and is appropriately

[3] Metropolitan Washington Council of Governments; Round 8.1 Cooperative Forecasts; July 2012; www.mwcog.org

adjusted in accordance with the Consumer Price Index in the Greater Washington Metropolitan Area.

Table 2. Solid Waste Facilities in Prince George's County

Facility Type	County Owned	Privately Owned
Material Recovery Facility - Recycling	Prince Georges County Materials Recovery, Capitol Heights	Encore Recycling, Laurel
		GSS Automotive Recycling, Landover
		IESI Maryland Corporation, Capital Heights
		Metro Re-Uz-It, Hyattsville
		New Horizons, Cheverly
		World Recycling, Cheverly
Composting Facility	City of College Park Composting Facility, College Park	There are no privately-owned composting facilities in the County
	Western Branch Yard Waste Composting Facility, Upper Marlboro	
Construction/ Demolition Recovery	The County does not own C&D Recovery Facilities	Dower House Road Recycling and Processing Facility, Upper Marlboro
		Recycle One, Hyattsville
		Sheriff Road Processing & Transfer Station Facility, Brandywine
		Sun Services LLC Recycling Facility, Beltsville
HHW Acceptance/Storage	The County does not own HHW Acceptance/Storage Facilities, but administers a program to manager materials	Adelphi Laboratories, Adelphi
		University of Maryland, College Park
		Ritchie Land Reclamation Limited Partnership Facility, Upper Marlboro
Convenience Centers (residential drop-off of recyclables, yard waste, and trash)	Brown Station Road Convenience Center, Upper Marlboro	There are no privately-owned Convenience Centers in the County
	Missouri Avenue Convenience Center, Cheltenham	
Construction/ Demolition Disposal - Rubblefill	The County does not own a Rubblefill	Ritchie Land Reclamation Limited Partnership Facility, Upper Marlboro
MSW Disposal - Landfill	Brown Station Road Sanitary Landfill, Upper Marlboro	There are no privately-owned landfills in the County

Waste generated by commercial (including industrialized and institutional) and multi-family properties is collected by private haulers on an individual subscription basis. The County does not franchise haulers for the collection of commercial or multi-family waste.

The County uses financial mechanisms to encourage waste disposal at the County landfill. The County rebates some of the tipping fee for municipal clients to encourage them to use the landfill. The County can adjust the landfill tipping fees to cover their costs as needed. The County's landfill does not accept commercially generated construction and demolition debris.

There are a number of municipalities within the County that take responsibility for collecting solid waste from residents living in incorporated areas. In these instances, the municipalities collect solid waste from private residents within their jurisdiction using their own equipment and trucks or contract out the service. Approximately 87,600 single family households receive waste collection in incorporated areas[4]. **Exhibit 2** presents a map of the municipalities and unincorporated areas of the County.

In the southern more rural areas of the County, residents contract directly with private haulers for the collection of solid waste and recyclables. The County also owns and operates two citizens' convenience at the landfill and in Cheltenham for residents to drop-off solid waste and recyclables.

RECYCLING

Recycling Collection

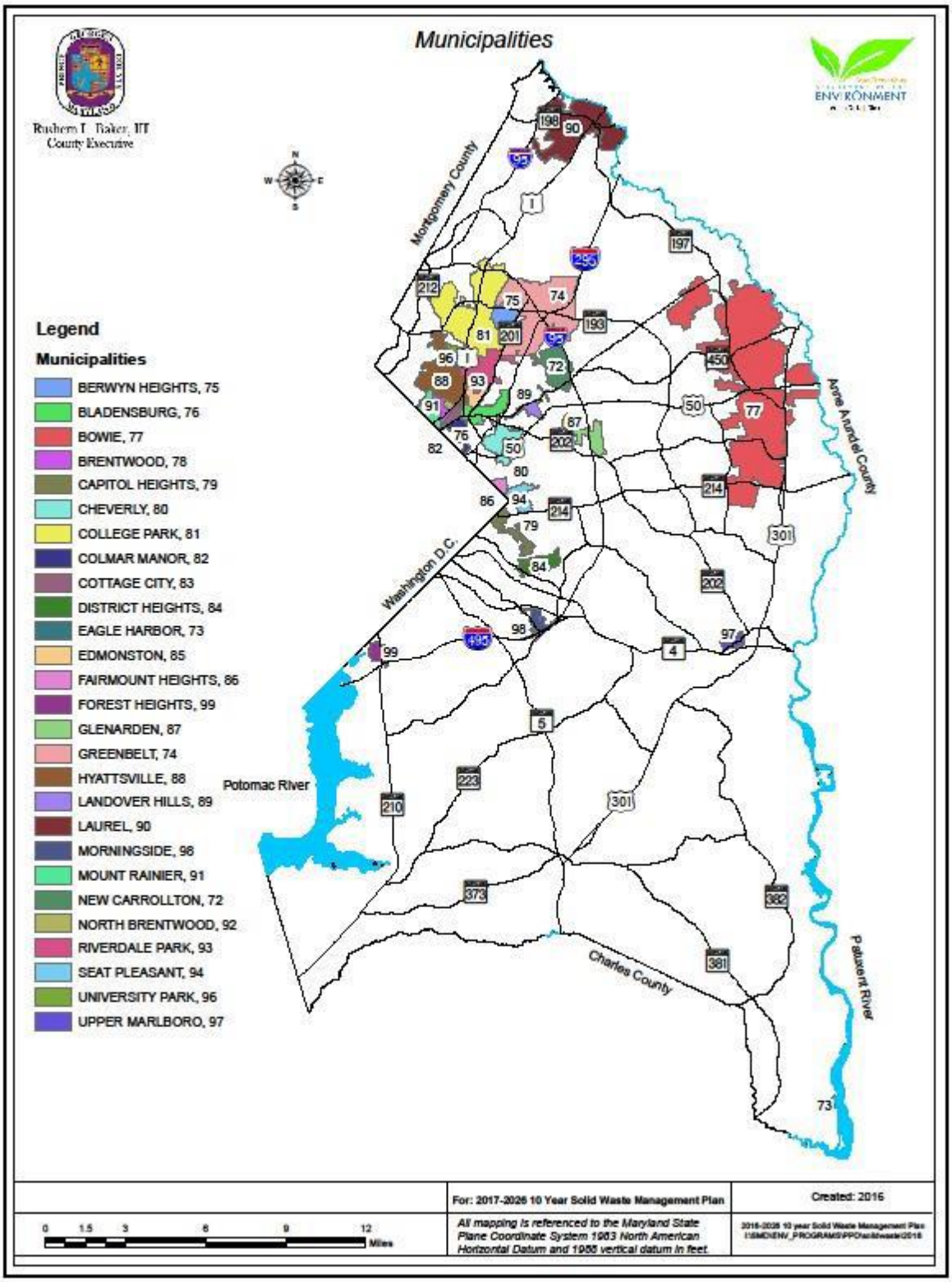
Recycling services are provided to residents through County contracts with private haulers. The County contracts with several private haulers for curbside recycling collection services for about 172,000 households. There are more households receiving recycling services due to the participation of several municipalities in the County's program.

Most municipalities manage curbside recycling services for their residents. Beginning July 1, 2015, the surcharge for recycling collection was $59.73 for the unincorporated areas of the County and $47.79 for participating municipalities. The County does not provide recycling services to commercial, industrial, or institutional customers, or to multi-family apartments in the County. Currently, nine municipalities have contracted with the County for recyclables collection, 17 collect recyclables with their own equipment, and one municipality has arranged for its citizens to use the County's drop-off facility. The owners of commercial, industrial, institutional, and multi-family properties are required to contract with private haulers for the collection of recyclables from their properties.

In 2014, the County implemented a mandatory commercial and business property recycling program. The law requires all commercial property owners in Prince George's County to provide their employees, tenants, and customers with the opportunity to recycle materials. Property managers must arrange for separate recycling collection services.

[4] Prince George's County, Maryland Comprehensive Ten-Year Solid Waste Management Plan, 2017, page III-4.

Exhibit 2. Map of Municipalities and Unincorporated Areas



Recyclables Processing

Prince George's County owns and operates a Materials Recovery Facility (MRF). This facility, which was constructed in 1993, was designed to process recyclables that are collected from the County's single-family residences for end-markets. In 2007, the MRF was upgraded with new equipment for processing recyclables using single stream technology[5]. During this same time period, the County changed their recyclables collection program from dual stream to single stream. Maintaining ownership of the MRF provides the County with the ability to manage, maintain, and expand their recycling program in order to capture more materials for recycling.

Several privately owned and operated MRFs also operate in the County. These facilities mainly receive recyclable materials that are collected from the commercial and construction and demolition sectors of the County and from entities outside the County. These facilities must receive an annual license from Prince George's County and provide annual tonnage numbers from recyclables received that were generated in Prince George's County.

Recycling Measurement

The Maryland Recycling Act (MRA), passed in 1988, requires that each of Maryland's jurisdictions develop and implement recycling programs and report the amount and types of materials recycled annually. To facilitate comparisons of recycling rates among Maryland's jurisdictions, the MRA specifies the material types that can be included in the recycling rate calculation.

In general, materials that can be included in the calculation of the MRA rate are traditional recyclables (commingled containers and various grades of paper) and compostables (yard trimmings and food scraps). A summary of MRA-specified materials and associated quantities diverted in 2015 is presented in **Table 3**

Other materials that are diverted from landfill disposal but do not count toward the MRA rate (such as construction and demolition debris, solvents, motor oil, light ballasts, etc.) are tallied and reported by the County but do not count in the MRA rate. A summary of non MRA-specified materials and associated quantities diverted in 2015 is presented in **0.**

COMPOSTING

In May 2013 the County implemented a pilot food waste composting program at the Western Branch Yard Waste Composting and Transfer Station Facility. Clean food scraps from the University of Maryland and the Town of University Park's curbside food collection program, along with food scraps from other sources are brought to the facility for composting. As presented in **Table 3**, the County composted 107,207 tons of yard trimmings and food scraps in 2015

[5] Prince George's County, Maryland Comprehensive Ten-Year Solid Waste Management Plan, 2017, page 3

Table 3. MRA-Specified Material Quantities Diverted Recycled and Composted, 2015

Material Type	Annual Tonnage (2015)		
	Residential	Commercial	Total
Commingled Containers	**64**	**949**	**1,013**
Glass	**10,725**	**1,456**	**12,181**
Metals	**1,327**	**151,836**	**153,163**
Aluminum Cans	214	445	660
Mixed Cans	527	1,301	1,829
Tin/Steel Cans	585	587	1,172
White Goods	0	149,503	149,503
Paper	**37,293**	**153,017**	**190,310**
Mixed Paper	35,068	39,729	74,797
Newspaper	1,391	11,068	12,460
Office/Computer	0	7,971	7,971
Old Corrugated Cardboard	833	94,176	95,009
Other Paper	0	73	73
Plastic	**4,776**	**4,807**	**9,583**
Mixed Plastic	3,986	4,273	8,259
Rigid Plastic	789	216	1,006
Other (film, toners, hangers, etc)	0	318	318
Other Recyclable	**250**	**12,643**	**12,893**
Fluorescent Lights	0	54	54
Lead Acid Batteries	1	1,336	1,337
Cell Phone Batteries	0	8	8
Oil Filters	0	1,026	1,026
Other Metals	0	105	105
Animal Protein/Solid Fat	0	432	432
Electronics	249	463	712
Pallets	0	479	479
Textiles	0	5,103	5,103
Tires[1]	0	3,638	3,638
Compostable	**54,008**	**53,199**	**107,207**
Brush & Branches	9,103	6,894	15,997
Grass	8,465	654	9,119
Leaves	6,968	2,301	9,269
Mixed Yard Trimmings	29,472	9,910	39,382
Food Scraps	0	8,199	8,199
Wood Materials	0	13,932	13,932
Manure	0	11,308	11,308
Total Recycled & Composted	**108,442**	**377,908**	**486,350**

1 Tires are burned

Table 4. Non-MRA Material Quantities Diverted Recycled and Composted, 2015

Material Type	Annual Tonnage (2015)		
	Residential	Commercial	Total
Construction & Demolition Debris	**0**	**144,543**	**144,543**
Antifreeze	0	83	83
Asphalt	0	8,838	8,838
C&D Debris	0	80,760	80,760
Concrete	0	48,041	48,041
Land Clearing Debris	0	6,821	6,821
Metals	**0**	**229,626**	**229,626**
Scrap Automobiles	0	31,506	31,506
Scrap Metal	0	198,120	198,120
Soils	**0**	**59,064**	**59,064**
Tires	**1**	**15**	**16**
Waste Oil	**9**	**2,344**	**2,353**
Spirits/Solvents	**0**	**245**	**245**
Total Recycled & Composted	**10**	**435,837**	**435,847**

SOURCE REDUCTION

The impact source reduction has on eliminating waste is often challenging to measure. The State of Maryland requires all counties to complete a source reduction checklist to indicate their involvement in activities that are considered source reduction. Prince George's County's 2014 source reduction checklist listed 17 source reduction activities completed:

- **Management of Yard Trimmings (Part 1 of the source reduction checklist)**

  1. Ongoing, multi-faceted, public education program - grasscycling and/or home composting

  2. Within the past 3 years, distributed publications to at least 30% of single-family households in the County

- **General Education (Part 2 of the source reduction checklist)**

  3. Staffed a source reduction display

  4. Hosted a source reduction event for the general public

  5. Incorporated source reduction information into the County website

  6. Promoted source reduction in schools on an ongoing basis

7. A source reduction curriculum or ongoing activity in schools

8. Integrated source reduction into ongoing County employee training and education programs

9. Within the past 3 years, distributed source reduction materials to at least 30% of residents

10. Within the past 3 years, distributed source reduction materials to at least 30% of businesses

11. Within the past 3 years, developed/updated a solid waste reuse directory

12. Developed/maintained a system for providing materials to a reuse center

13. Conducted a source reduction training session, workshop, or presentation at a business, institution or community event

14. Operated a program to promote pallet reuse

15. Within the past 3 years, conducted source reduction site visits to 3 or more of the businesses with the most employees or the most waste

16. Within the past 3 years, conducted a source reduction waste audit or survey of county facilities where at least 10 percent of county employees worked

17. Held team meetings, a least quarterly, that included representatives from major county departments, in which source reduction was discussed as a formal part of the agenda

WASTE DISPOSAL

Prince George's County tracks waste materials managed at its landfill by weight (tons). Large scales at the entrance to the landfill measure both incoming and outgoing vehicle loads (full and empty). Fees for trash and other materials are mostly based on the weight of the materials.

Table 5 summarizes the waste materials and quantities (weights) received at the landfill in 2015. Most of the waste delivered is residential and commercial MSW, including waste from the County's public schools which is estimated to be about 10,000 tons. Over 1,600 tons of tires, wood waste, and metal are also brought to the landfill: tires are transported out-of-state for recycling, metal is transported to recycling facilities in the County, and wood is transported to the County's composting facility. The landfill does not accept waste materials generated outside the County.

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Table 5. Waste Managed at the Brown Station Road Sanitary Landfill, 2015

Generating Sector		Annual Tonnage
MSW	Residential	208,000
	Commercial	58,000
	Public Schools	10,000
	Subtotal	**276,000**
Other	Tires	395
	Scrap Metal	962
	Foam/Carpet Padding	18
	Subtotal	**1,375**
Total Annual Tonnage		**277,375**

Characterization of Wastes Received at the County Landfill

SCS Engineers conducted a waste composition analysis of residential, commercial, and public school waste disposed of at the landfill. The primary objectives of the study were to:

- Estimate types and quantities of recyclable and compostable waste components in the waste stream;
- Identify opportunities for greater waste stream diversion; and
- Create a baseline waste composition in order to measure the effectiveness of diversion efforts.

This waste characterization project consisted of four sampling events beginning in the fall of 2014 and finishing in the summer of 2015. All sampling and sorting activities were conducted at the landfill. The data generated can be used by the County to develop long-term waste management strategies and to evaluate the effectiveness of current diversion programs.

Waste Streams Assessed

Different waste streams have the potential to have different types of materials in different quantities. In order to understand the composition of the waste disposed of at the landfill, SCS developed a sampling plan based on tonnage reports from 2014. Wastes sampled at the landfill come from four source types:

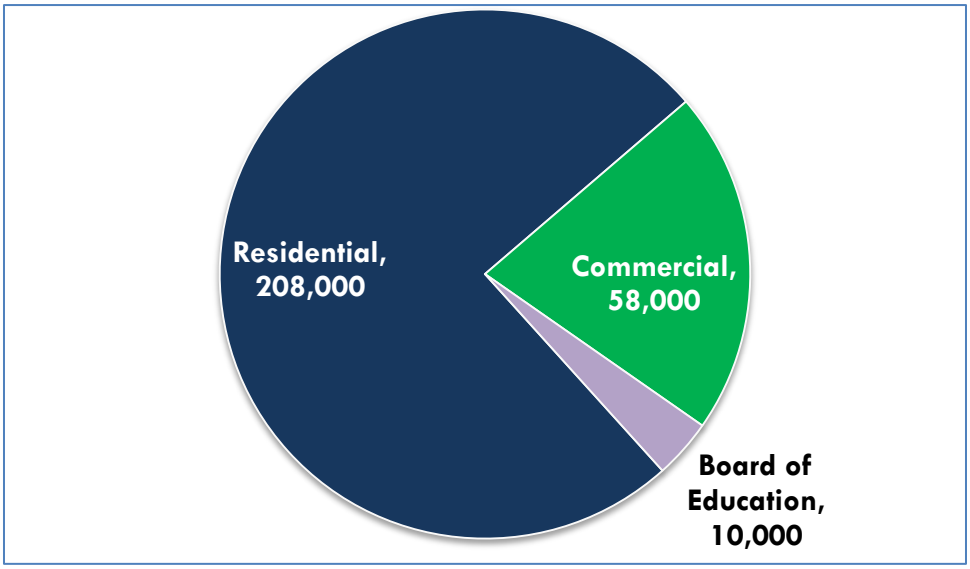
- **Commercial:** Collected by private haulers through contracts with individual businesses and organizations. A significant portion of commercial waste is disposed outside of the County due to economic and logistic considerations of private haulers.
- **Public Schools:** Collected by the County Board of Education.

- **Residential – County Contract:** Collected by private haulers.

- **Residential – Municipal:** Collected by municipal crews or private haulers under municipal contract.

Exhibit 3 presents the distribution of waste by source that is delivered annually to the landfill. A total of 200 waste samples were obtained for the study (50 waste samples for each of the four seasonal field activities). The number of samples from each source was proportional to the annual tonnage received at the landfill. For example, residential waste is 65 percent of MSW received at the landfill; therefore, 65 percent of the samples (130 samples) were gathered for the study from residential truckloads.

Exhibit 3. Distribution of MSW Tonnage Delivered Annually to the Brown Station Road Sanitary Landfill



Material Categories

Table 6 summarizes the material categories into which the waste streams were sorted. The five major categories included:

- **Recyclable Paper** – Materials in this major category are collected from each of the four sources. These materials are also accepted at the County's Material Recovery Facility (MRF).

- **Recyclable Containers** - Materials in this major category are collected from each of the four sources. These materials are also accepted at the County's Material Recovery Facility (MRF).

- **Divertible** – Materials in this major category can be diverted from landfill disposal though special programs.

- **Compostable** – Materials in this major category can be included in the County's composting program.

- **Other** – Materials in this major category do not generally have markets for their recycling or recovery and cannot be composted.

Table 6. Description of Material Categories

Material Categories		Examples
Recyclable Paper	Newspaper/Print (ONP)	Daily, weekly newspapers
	Corrugated Cardboard (OCC)	Packing/shipping boxes
	Magazines/Catalogs/Other Books	TV Guide, periodicals, journals, hard cover books
	Kraft Paper/Boxboard	Grocery/shopping bags, paper grocery bags, soda boxes, cereal boxes
	Office Paper/Junk Mail/Misc. Paper (Mixed Paper)	Copy paper, computer printouts, envelopes, brochures, flyers, junk mail, receipts, notebook paper
	Aseptic/Wax Coated Paper	Milk and juice cartons, juice boxes
Recyclable Containers	PET (#1) Bottles	Plastic water and soda bottles, marked #1
	HDPE (#2) Bottles	Milk and detergent bottles, marked with #2
	Other (#3-#7) Bottles	Prescription bottles, syrup bottles
	Jars, Jugs, Tubs, Trays	Jars/Jugs/Tubs/Trays marked with #1 through #5.
	Flower Pots	Recyclable flower pots, usually marked #5
	Other Rigid Plastic	Storage totes, furniture, toys, not marked with a #
	Ferrous Cans	Pet food cans, soup cans, fruit cans, aerosols
	Aluminum Cans/Foil	Soda, beer cans, and aluminum foil
	Glass Bottles/Jars	Beer, wine, soda bottles, all colors
Divertible	Electronics	Corded electronics, cell phones, appliances, cathode ray tube monitors (CRTs)
	Paint	Latex and oil-based paint
	Scrap Metal	Copper tubing, clothing hangers, machine parts, etc.
	Pallets/Lumber	Forklift pallets, plywood, 2x4's, dimensional lumber
	Other Wood	Tree stumps, wooden chairs, misc. wooden items
	Concrete/Brick/Rock	Gravel, bricks, stones, broken-up asphalt, concrete
	Dirt	Soil, rocky soil, clay, potting soil, silt, dirt
	Sheet Rock	Drywall or gypsum board
	Carpet/Carpet Padding	Vinyl siding used for exterior house siding
	Shingles	Forklift pallets, and other lumber materials
	Textiles *	Clothing, upholstery, fabrics
	Shopping Bags *	Grocery bags and shopping bags comprised of plastic film

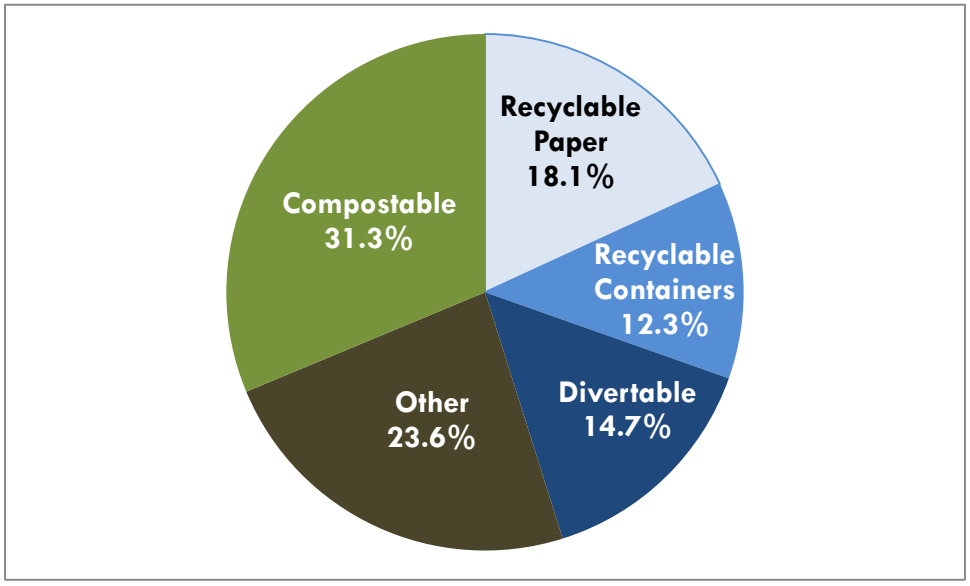
Material Categories		Examples
Compostable	Compostable Paper	Tissues, napkins, paper towels
	Vegetative Food	Fruits, vegetables and rinds, breads
	Non-Vegetative Food	Meats, Dairy products
	Leaves	Leaves and pine needles
	Grass	Lawn clippings and hay
	Brush	Branches, brush, small sticks and twigs
Other	Furniture	Tables, chairs, couches, other furniture
	Plastic Film *	Tarps, bubble wrap, cellophane chip bags
	Garbage Bags *	Plastic film bags used to contain trash
	Polystyrene	Expanded/regular clamshells, cutlery, cups
	Other MSW	Materials not otherwise categorized including kitty litter, diapers, ceiling tiles, fines, and indistinguishable/small materials

* Indicates materials sorted in June 2015 only

Residential Waste Composition

An estimated 65 percent of the weight of MSW deposited at the landfill is from residential sources. **Exhibit 4** presents a graphic summary of the major material classifications of residential waste estimated from 130 waste samples collected and sorted during the four field activities. Over 75 percent of the weight of residential waste is classified as recyclable, compostable, or divertible.

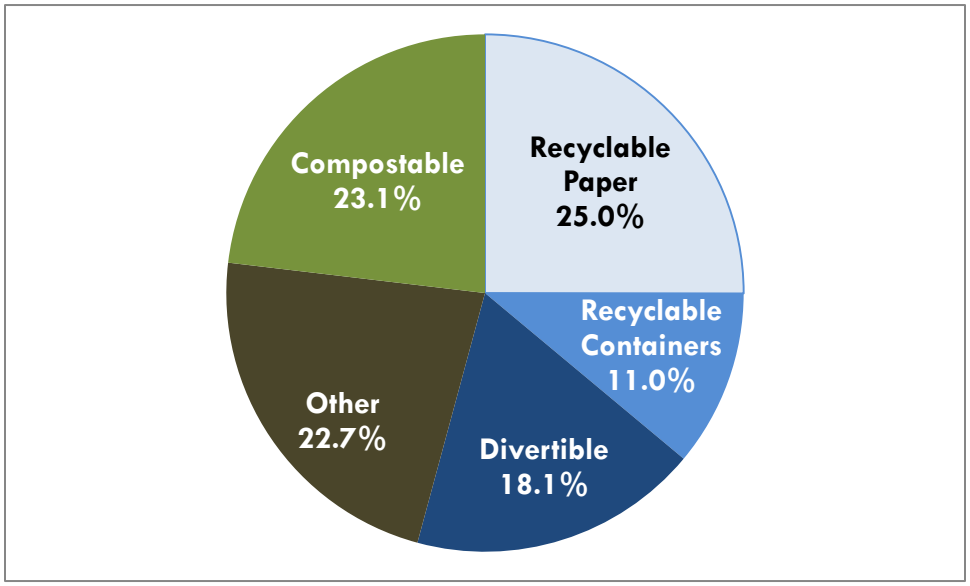
Exhibit 4. Residential Waste Composition of Major Material Categories By Weight



Commercial Waste Composition

An estimated 31.5 percent of the weight of MSW deposited at the landfill is from commercial sources. **Exhibit 5** presents a graphic summary of the major material classifications of commercial waste estimated from 63 waste samples collected and sorted during the four field activities. Over 75 percent of the weight of commercial waste is recyclable, compostable, or divertible.

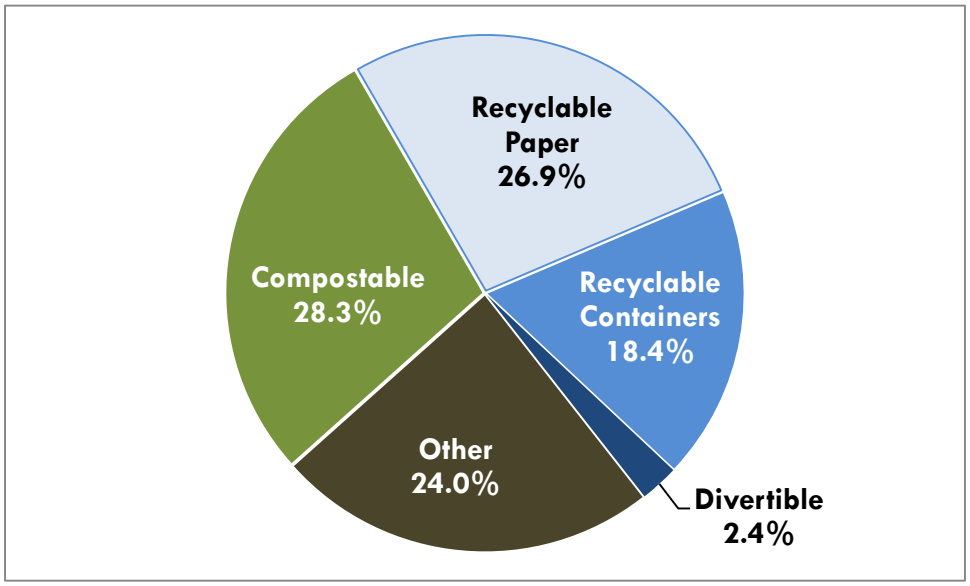
Exhibit 5. Commercial Waste Composition of Major Material Categories By Weight



Public School Waste Composition

An estimated 3.5 percent of the weight of MSW deposited at the landfill is from public schools. **Exhibit 6** presents a graphic summary of the major material classifications of public school waste estimated from seven waste samples collected and sorted during the four field activities. Over 75 percent of the public school waste stream by weight is recyclable, compostable, or divertible.

Exhibit 6. Public School Waste Composition of Major Material Categories By Weight



Annual Waste Quantities Disposed at the Landfill

Material quantities disposed annually at the landfill were estimated from the waste characterization data and rounded to the nearest 100 tons annually due to proper use of significant figures. Material types calculated to be less than 100 tons annually are presented as "<100" in **Table 7**.

Materials for which more than 10,000 tons are disposed annually include:

- **Residential Sources:**
  - Vegetative Food (24,300 tons),
  - Compostable Paper (14,600 tons),
  - Plastic Film (13,600 tons),
  - Office Paper / Junk Mail / Misc. Paper (11,200 tons),
  - Textiles (10,900 tons), and
  - Non-Vegetative Food (10,700 tons).

- **Commercial Sources:**
  - Corrugated Cardboard (10,600 tons).

Table 7. Annual Tonnage of Materials Disposed at the Landfill

Material Components		Source			
		Residential	Commercial	Schools	Total
Recyclable Paper	Newspaper/print	6,300	700	<100	7,000
	Corrugated Cardboard	7,100	6,800	1,000	15,000
	Magazines/Catalogs/ Other Books	2,200	1,000	100	3,300
	Kraft Paper/Paperboard	7,000	1,200	200	8,400
	Office Paper/Junk Mail/Misc. Paper	11,400	3,800	1,000	16,300
	Aseptic/Wax Coated Paper	3,700	1,000	200	4,900
	Subtotal	**37,700**	**14,500**	**2,700**	**54,900**
Recyclable Containers	PET (#1) Bottles	4,100	1,200	400	5,700
	HDPE (#2) Bottles	2,300	400	200	2,900
	Other (#3-#7) Bottles	100	<100	<100	200
	Jars, Jugs, Tubs, Trays	2,800	1,000	100	3,800
	Flower Pots	200	<100	<100	200
	Other Rigid Plastic	4,500	1,700	200	6,400
	Ferrous Cans	2,300	300	<100	2,700
	Aluminum Cans/Foil	2,000	400	<100	2,500
	Glass Bottle/Jars	7,200	1,300	800	9,300
	Subtotal	**25,500**	**6,400**	**1,800**	**33,800**
Divertible	Electronics	1,900	300	<100	2,200
	CRTs	<100	400	<100	400
	Paint	300	<100	<100	300
	Scrap Metal	2,100	700	<100	2,900
	Pallets/Lumber	1,800	1,800	<100	3,600
	Other Wood	4,300	1,400	<100	5,800
	Concrete/Brick/Rock	700	<100	<100	800
	Dirt	1,500	200	<100	1,700
	Sheet Rock	1,700	100	<100	1,800
	Carpet/Carpet Padding	1,400	2,200	<100	3,700
	Shingles	700	300	<100	1,000
	Textiles	11,100	2,500	<100	13,600
	Shopping Bags	3,100	500	<100	3,700
	Subtotal	**30,600**	**10,500**	**200**	**41,400**
Compostable	Compostable Paper	14,900	4,200	700	19,800
	Vegetative Food	24,800	5,300	1,500	31,600
	Non-Vegetative Food	10,900	1,900	200	13,100
	Leaves	5,800	400	300	6,600
	Grass	3,500	700	<100	4,200
	Brush	5,300	800	<100	6,000
	Subtotal	**65,100**	**13,400**	**2,800**	**81,300**
Other MSW	Furniture	1,400	400	100	1,900
	Plastic Film	13,900	5,400	800	20,100
	Garbage Bags	4,200	1,300	<100	5,600
	Polystyrene	3,900	1,100	200	5,200
	Other MSW	25,700	4,800	1,200	31,700
	Subtotal	**49,000**	**13,100**	**2,400**	**64,600**
TOTAL		**208,000**	**58,000**	**10,000**	**276,000**

3 ZERO WASTE INITIATIVES

Prince George's County has positioned itself as a leader in the management of solid waste. The County has already established a number of programs and policies that encourage the reduction and recovery of solid waste. In 2015, the latest data available, the County's recycling rate was 59.5 percent, the highest in the State of Maryland.

Moving to zero waste may require the enhancement of many existing programs along with the establishment of new policies and programs to further reduce waste and increase recovery across all generating sectors. These generally can be classified as:

- **Upstream** – Policies and programs to support re-design strategies to reduce the volume and toxicity of discarded products and materials, and promote low-impact or reduced consumption lifestyles.

- **Downstream** – Policies and programs to address reuse, recycling and composting of end-of-life products and materials to ensure their highest and best use.

The following discussion looks at initiatives the County could evaluate and adopt in order to move toward zero waste in each of the waste generating sectors in the County, including residential, commercial, industrial, institutional, and County-owned facilities. Many of these initiatives are complementary of each other and must be implemented together in order to achieve success. For example, the County would need to develop or facilitate the development of composting infrastructure before requiring food waste collection from commercial sources.

The County has the authority to implement programs that can facilitate moving toward zero waste. Subtitle 21 of the County Code specifically addresses solid waste management and recycling. It includes requirements for establishing a voluntary recycling program, mandatory requirements for apartment owners to provide recycling opportunities for their tenants, and implementation of a pilot food waste composting program. Furthermore, Subtitle 19 of the County Code specifically addresses pollution and includes an expanded polystyrene ban for use in food service products and loose-fill packaging.

ADOPT A ZERO WASTE PLAN

The County Council could adopt a zero waste goal and a costed, prioritized plan to achieve it, while incorporating it into the Ten Year Solid Waste Management Plan. The County could establish an incremental timeline to track the County's progress in working toward the zero waste goal. One possible timeline would mirror the State's goal of 85 percent waste diversion by 2040. Achieving zero waste will take time and require the participation of all stakeholders across Prince George's County.

The County Council's adoption of a zero waste goal and implementation plan would serve two very important purposes. First, it would provide the legal and policy support for the Solid Waste Division to make decisions regarding solid waste management that support zero waste goals. Revisions to existing policies and program and development of new programs and policies will be needed to move the County toward zero waste. Second, it would demonstrate to the

community that the County is serious about zero waste. When residents and business owners in Prince George's County see the County's, leadership making a commitment to zero waste, it will support and bolster the Resource Recovery Division's work to achieve this goal. The County could provide resources that are essential to the Resource Recovery Division's ability to successfully modify and expand programs leading toward zero waste.

PRIORITIZE SOURCE REDUCTION AND REUSE PROGRAMS

Source reduction and reuse are the highest priority initiatives in minimizing waste. These programs can often be overlooked because measuring their impact on the waste stream can be challenging as they are geared toward avoiding waste generation.

Promote Source Reduction

Source reduction is an important initiative to move the County towards zero waste. Source reduction is often overlooked because it is fundamentally different than other waste management strategies – it seeks to prevent waste generation. Source reduction strives to change the way products are produced, manufactured, distributed, transported, sold, and/or consumed in order to avoid waste generation in the first place.

The County has implemented several programs that highlight the importance of source reduction to residents and businesses. Source reduction ideas are included in the County's public education material, including on displays, in presentations, and on the County's Facebook page and website. The Resource Recovery Division's staff is available to give source reduction presentations, and coordinate with other County departments to inform residents and businesses on where they can donate used materials to avoid disposal.

The County takes source reduction seriously and is leading by example in their own offices and facilities. In 2007 the County implemented the "Going Green Initiative" whereby the County established goals for expanding green building practices into newly constructed county buildings.

Encourage Reuse

Supporting and encouraging reuse programs is one way that the County can bring together residents that would like to discard unwanted items residents who are looking for used items in good condition. Reuse aims to extend the life of products by using them over and over again. According to the Institute of Local Self-Reliance, for every 10,000 tons of materials that are managed through reuse programs, 75 to 250 jobs are created[6] . These programs have multiple benefits, including:

- Providing residents with low-cost materials in good condition;
- Creating jobs through the collection and redistribution of materials; and
- Keeping these materials from ending up in landfills or incinerators.

[6] Waste to Wealth; Recycling Means Business, 10 December 2008. Institute for Local Self-Reliance. http://www.ilsr.org/recycling/recyclingmeansbusiness.html

There are a number of organizations engaged in reuse in Prince George's County. Community Forklift is a non-profit reuse center for home improvement supplies. They collect unwanted building materials throughout the DC Metro Region and make these materials available to the public at low-cost. They also distribute free supplies to residents in need and non-profits. Community Forklift has recovered over $12 million of building materials from the DC Metro Region and has provided supplies to 20,000 homeowners, non-profits, businesses, and artisans[7]. There are also a number of thrift stores in Prince George's County, such as Purple Heart in Bladensburg, AMVETS in Lanham; and American Rescue Workers in Capit0l Heights, that provide low-cost clothing and home goods to residents.

Other municipalities across the country host repair stations that aim to fix materials that are broken to extend their life. For example, the City of Santa Monica, California, hosts regular Repair Cafés[8]. The City arranges for volunteer "fixers" to help residents repair items such as lamps, toasters, clothes, toys, bikes, and hair dryers. Residents are encouraged to bring items needing repair to the café, and the volunteers will attempt to fix them. Repair services are offered for free, and customers pay for replacement parts.

Repair Revolution[9] in Oakland, California, follows a similar model. Their repair "salon" consists of skilled artisans and repair professionals that give new life to broken materials. They educate and inspire the community around repairing items and make it easy for people to fix the things they love. Repair Revolution repairs or fixes anything from bicycles, shoes, clothes, knives, furniture to many other household goods that are too good to throw away.

Other local governments provide opportunities for reuse and donation onsite at their disposal facilities. The Metro Regional Government in Portland, Oregon, owns two regional transfer stations. The private companies that operate the facilities have partnered with local non-profits which are allowed to stage their equipment at the transfer station for customers to donate the materials onsite. One non-profit even provides staffing at the transfer station to recover materials for resale. In 2015, over 270 million tons of materials were diverted to reuse markets in Portland[10].

The County could consider implementing the following initiatives to support reuse programs:

- Identify materials that can be reused, but are not currently accepted as part of any established reuse programs; explore ways to start recovery of these items for reuse.

- Host a "repair café" that features local artisans and repair professionals offering their services to the public. Such events may be held in conjunction with community events throughout the County.

- Develop a comprehensive database of reuse programs, repair services, and donation centers in the County so residents have easy one-stop access to opportunities to

7 Community Forklift, 2015. www.communityforklift.org

8 https://www.smgov.net/departments/publicworks/contentrecycling.aspx?id=53150

9 https://ecologycenter.org/events/repair-revolution/

10 Erickson, Penny, Transfer Stations Operations Supervisor, Metro Regional Government. Email communication February 18, 2016

extend the lives of their materials. Businesses and residents could use the database through the County Click 311 information center or through the County's website.

- Provide financing, grants, and/or subsides to individuals and businesses to develop businesses in the County for reuse and donation of materials.

Support Disposal Bans

One of the most effective ways to control or eliminate the disposal of certain materials is to utilize "disposal bans." A disposal ban prohibits designated types of waste from landfills and incinerators. Disposal bans can vary from state to state on the types of materials targeted, the quantity targeted, and other specific conditions. For example, Montana has no disposal bans in place whereas Maryland has disposal bans on the following:

- Automobiles
- Lead Acid Batteries
- Liquid Wastes
- NiCad Batteries
- Tires
- Untreated Infectious Waste
- Yard Waste (grass, leaves, brush)
- Animal Carcasses
- Chemical or Petroleum Cleanup Material
- Controlled Hazardous Substances
- Drums and Tanks

Disposal bans are usually implemented to reduce the quantity of material in the landfill and to create markets for the recycling and/or composting of the material. The State of Maryland Draft Zero Waste Plan recommends that the State inventory other materials for which there is already adequate recycling capacity or for which disposal produces particular environmental harm, including:

- Electronics
- Latex paint;
- Carpet;
- Metal;
- White goods
- Commercial and institutional organics
- Gypsum wallboard;
- Wood;
- Asphalt and concrete;
- Batteries; and
- Mercury dental amalgam and other mercury-containing products

Intensify Education and Enforcement of the Expanded Polystyrene Ban

Expanded polystyrene, also known as polystyrene foam, is the material of which many single-use food containers are made. It is not biodegradable and is rarely recycled because of food contamination and its high volume-to-weight ratio that complicates its efficient transport. The 2015-16 Waste Characterization Study estimated that 5,700 tons of expanded polystyrene is deposited at the landfill annually, about 1.9 percent of all municipal solid waste and eight percent of the waste that can't be reused, diverted, recycled, or composted.

Aside from contributing to the waste buried in the landfill, polystyrene foam is a major component of roadside litter and pollutes our waterways. Fortunately, there are many substitutes for single-use foam food containers that are either compostable or recyclable.

In April 2015, the Prince George's County Council banned the provision or sale of single-use expanded polystyrene food containers and packing peanuts by food service establishments and retailers. The ban went into effect on July 1, 2016. The county notified all county businesses of the ban via a large postcard just as the ban went into effect and has intervened with a number of suppliers of foam food containers to ensure compliance.

Evidence from the field suggests that sale and provision of expanded polystyrene containers have declined and compliance with the ban has risen significantly.

- A representative survey of 186 restaurants county-wide conducted by the Prince George's Sierra Club found that compliance with the ban rose from 25 percent in 2015 to 46 percent one month after it went into effect in 2016. The major reason for non-compliance was lack of awareness of the ban – only about half were aware of it.

- Systematic monitoring by the Sierra Club in Spring 2017 of 465 businesses in 45 shopping centers in northern and central Prince George's County – including restaurants, retailers, pharmacies, gas stations, packaging stores, hotels, and theaters – found an overall compliance rate of 76 percent for all businesses and 78 percent for restaurants. Again, however, only a little more than half of the businesses were aware of the ban.

- Compliance across all businesses rose to 91 percent in October 2017, following the educational intervention on the ban in the spring. Roughly half of non-compliant businesses were already in the process of drawing down their stocks of foam containers.

These results suggest that when businesses are adequately informed of the ban and educated on the reasons and how to comply, they willingly switch to alternatives. Further, there is turnover in businesses and in employees within businesses, so educational efforts are important on a continuing basis. The expanded polystyrene campaign could be made more effective by:

- Expanding and sustaining the information campaign to the public and to businesses and business communities, overall and particularly to non-native English speakers, as the postcard notification was in English and translated materials exist only on the website.

- Enlisting the help of county health inspectors in informing businesses and reporting infractions, and the help of municipalities in enforcing the ban within their jurisdictions.

- Systematically reaching out to institutional users of single-use containers, like hospitals, cafeterias, gyms, and hotels, to make them aware of the ban.

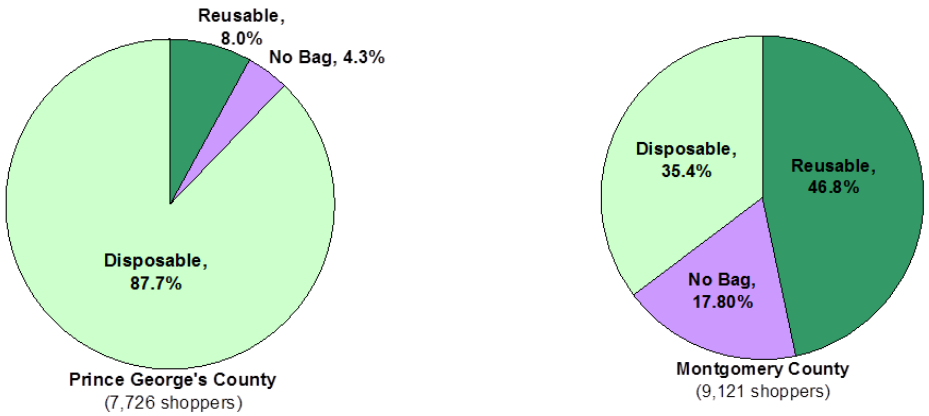
- Developing placards to display on the shelves at retail locations advertising Prince George's "foam free" status, reminding customers and managers that polystyrene containers are not for sale and should not be re-stocked.

Ban or Require a Fee for Single-Use Disposable Bags

Shopping bags comprise 1.5 percent of the waste stream in Prince George's County and it is estimated that 3,900 tons of shopping bags are disposed of at the County's landfill annually. While shopping bags do not comprise a large portion of the waste stream by weight, they provide an opportunity for the County to implement a source reduction policy that would substantially reduce the amount of shopping bags that enter the waste stream and that litter the County's roads and waterways. Both Montgomery County and the District of Columbia Government have implemented programs that place a five cent fee on all single-use bags dispensed in their jurisdictions. Implementing a similar policy for Prince George's County could provide consistency and expand this fee structure in the DC Region.

Placing a small fee on single-use carry-out bags has the potential to significantly change shopper behavior and result in a cleaner environment. The Prince George's Sierra Club conducted a survey in early 2014 that observed about 17,000 shoppers leaving the stores of five major grocery store chains in Prince George's and Montgomery counties. Volunteers recorded the number of shoppers using reusable bags, disposable bags, and a mix of reusable and disposable, or unbagged merchandise. The shoppers in Montgomery County (which has a five-cent fee on bags) were six times more likely to use reusable bags than shoppers in Prince George's County (**Exhibit 7**). Shoppers in Montgomery County were also four times more likely than in Prince George's County to hand carry their merchandise out of the store with no bag. Altogether, two-thirds of Montgomery County shoppers were avoiding use of disposable bags, compared with only 12 percent in Prince George's County, where there is no bag fee.

Exhibit 7. Comparison of Disposable Bag Use Among Shoppers in Prince George's County vs. Montgomery County[11]



The County's ability to enact and collect a single-use bag fee requires approval from the Maryland General Assembly. Because of this complication, the County may consider alternatives approaches to limit single-use bags, including:

1. **Single-Use Bag Ban.** A ban does not require the consent of the state legislature, or

[11] Source: Prince George's Sierra Club Group shopper survey, 2014

2. **County Mandate.** The County could require businesses to charge at least five cents for each single-use bag which would have the same impact on consumer behavior as a bag fee. Because the County would not be collecting the revenue, the mandate does not require approval from the state legislature.

In conjunction with the bag ban, the County could continue its efforts to educate the public on alternatives to using single-use carry out bags and make available for free reusable bags for residents.

SUPPORT AND IMPLEMENT PRODUCER RESPONSIBILITY PROGRAMS

Engaging producers and other entities involved in the development of products and packaging by encouraging, incentivizing, or requiring them to take responsibility for the products that they produce will minimize waste and reduce the burden on Prince George's County to manage waste materials.

Promote Extended Producer Responsibility (EPR) Policies

EPR aims to internalize the environmental costs of goods into the market price of the product. This model places a shared responsibility on the end-of-life management of goods to product manufacturers and all parties involved in the product supply chain. It also focuses on redesigning products to minimize the negative impact a product might have during its life cycle. This "upstream" initiative shifts the responsibility from consumers and local governments to product manufacturers to produce products that can more easily be recycled or reused and secondarily to retailers. There are several different types of EPR programs that can be implemented for various products (**Table 8**).

There are a number of products in the County's waste stream that EPR programs can be applied to, including:

- Electronics – 0.7 percent (2,400 tons disposed at the LANDFILL annually)
- Paint – 0.1 percent (400 tons disposed at the LANDFILL annually)
- CRTs – 0.2 percent (600 tons disposed at the LANDFILL annually)
- Carpet/carpet padding – 1.7 percent (4,800 tons disposed at the LANDFILL annually)

Other products entering the waste stream that can be covered by EPR initiatives include pharmaceuticals, medical sharps, tires, computers, toner cartridges, and mattresses. The State of Maryland has committed to establishing an EPR program for mattresses and investigating the potential for establishing other EPR programs for more materials[12].

The County could take an active role in advocating for legislation that requires product manufacturers, retail establishments, wholesale distributors and other appropriate entities to take

[12] *Zero Waste Maryland, Maryland's Plan to Reduce, Reuse and Recycle Nearly All Waste Generated in Maryland by 2040,* Maryland Department of the Environment, December 2014, page 48, accessed via http://www.mde.state.md.us/programs/Marylander/Documents/Zero_Waste_Plan_Draft_12.15.14.pdf

back certain products or packaging that currently are difficult to recycle, contain toxics or otherwise pose problems when they are discarded as waste. As part of internal procurement requirements, the County can preferentially support product manufacturers and businesses that have implemented EPR for their products.

Table 8. Types of Extended Producer Responsibility Programs

Type of EPR or Stewardship Approach	Methods	Examples
Product Take-Back	- Mandatory take-back - Voluntary or negotiated take-back	-- Sony Electronics national take-back and recycling program
Procurement/Consumer	- Procurement guidelines and policies - Information disclosure programs - Product specifications that require environmental performance standards	-- Prince George's County internal green purchasing requirements
Regulatory Approaches	- Disposal bans - Mandatory recycling - Product or material prohibitions	-- State of North Carolina disposal bans on tires, aluminum cans, white goods, and yard waste among others
Voluntary Industry Practices	- Public/private partnerships - Voluntary codes of practice - Leasing or "servicing" of products	-- Call2Recycle battery stewardship program -- Caterpillar Cat REMAN program to disassemble products and reuse parts
Economic Instruments	- Advanced recycling/disposal fees - Deposit/refund schemes - Product charges - Subsidies or tax credits for environmentally preferred products - Differential fees based on product's health or environmental impact	-- Electronic waste recycling fee in California -- Beverage container deposit laws in CA, OR, HI, IA, MI, CT, MA, NY, VT, ME

Source: California Product Stewardship Institute. http://www.calrecycle.ca.gov/EPR/About.htm

Support Statewide Container Deposit Legislation

According to the Waste Characterization Study conducted 2015, beverage containers make up 6.3 percent (14,924 tons) of Prince George's County's waste stream in the landfill, including:

- 2.0 percent #1 PET bottles;
- 0.9 percent aluminum cans and foil (90 percent assumed to be beverage cans); and,
- 3.4 percent for glass containers.

The County can support efforts at the State level to implement a container deposit program. A container deposit program (or "bottle bill" as it is commonly known) seeks to increase the recovery and recycling of containers (mainly aluminum beverage cans and plastic and glass

beverage bottles) by requiring refundable deposits be paid on containers when they are purchased. When consumers bring the empty containers back to retailers or redemption centers the deposit paid is refunded. Ten states currently have bottle bills with deposits of five cents up to 15 cents, depending on the size of the container. According to a market analysis by the Container Recycling Institute, in 2010 only 28 percent of the 4 billion beverage containers sold in Maryland annually were being recycled[13]. States that have bottle bills report high recycling rates of the covered containers, from 70 percent to 95 percent.

For purposes of evaluating the impact of a container deposit in Maryland, SCS' observations indicate about 75 percent of glass containers are beverage containers that would be covered by the program. SCS also calculated the energy value wasted and the greenhouse gas generation impact of the containers buried in the landfill. **Table 9** summarizes the calculations and results.

The energy required to produce the same amount of containers buried in the landfill annually from virgin raw materials is estimated to be 830 billion Btus (equivalent to the annual energy use of 8,700 homes). The greenhouse gas emissions prevented by recycling these materials instead of manufacturing from virgin materials are estimated to be nearly 12.6 billion tons (equivalent to the emissions of 8,400 cars annually).

Table 9. Impact of Bottle Bill on Prince George's County

Environmentla Benefits	Beverage Package Type			
	Aluminum Cans [1]	#1 PET Plastic Bottles	Glass Bottles [2]	Total
Number of Containers				
Percent of Waste Disposed at BSRSL	0.9%	2.0%	3.4%	6.3%
Annual Tonnage	2,430	6,300	7,425	16,155
Number of Containers/Ton [3]	68,420	26,505	4,000	22,466
Number of Containers Disposed Annually (millions)	166	167	30	363
Environmental Benefits				
Energy Saved by Recycling instead of Wasting				
Energy Saved per Ton (Mbtu/ton) [2]	207	53.4	8.6	55.9
Annual Energy Savings (Mbtu)	503,010	336,420	63,855	903,285
Equivalent to Annual Energy Use by This Number of Homes	5,300	3,500	700	9,500
Greenhouse Gas Reductions by Recycling instead of Wasting				
Million Tons of Carbon Equivalent per ton (MTCE/ton) [2]	3.96	0.54	0.08	0.84
Annual Greenhouse Gas Savings (MTCE)	9,600	3,400	600	13,600
Equivalent to Annual Emissions by This Number of Cars	6,400	2,300	400	9,100

1 Approximately 90 percent of Aluminum disposed are beverage cans

2 Approximately 75 percent of glass bottles would be covered under a statewide bottle bill.

3 Source: The Container Recycling Institute

[13] Container Recycling Institute, "Beverage Market Data Analysis, Maryland", 2015

Other benefits of a bottle bill in Maryland include reduced roadside litter and contamination of single-stream recycling by broken glass; increased recovery of glass for recycling; reduced expenditure on tipping fees for disposal; and job creation to transport, manage, and direct collected beverage containers. The County will continue exploring the operational and economic impacts of a bottle bill.

REINFORCE PUBLIC EDUCATION AND OUTREACH

Develop Communication/Outreach Plan for Marketing Zero Waste

To increase waste diversion the County must have the buy-in and support of various groups in the County – residents, business owners and employees, multi-family property managers and tenants, policy-makers, institutions, and other stakeholders. The County has a long history of engaging residents and organizations in decision-making processes to improve the community. Indeed, it was a group of citizens and businesses that pushed the idea of Prince George's County adopting a zero waste plan.

The value of recyclable paper and containers disposed of at the landfill is estimated to be over $8.7 million annually as presented in **Table 10.** Recovering these materials as well as compostable and divertible materials from the waste stream and placing them back into the economy will have a significant impact on local revenue, job creation, and business expansion.

With a zero waste goal the County could review all existing solid waste promotional materials to ensure they conform to zero waste. The County could also evaluate promotional materials and consider different media for their distribution. The overarching goal is to make sure residents of Prince George's County know about the County's goal and motivated to change their purchasing, consuming, and disposing habits to achieve this goal. Zero waste is likely to be met with skepticism from stakeholders, and having clear and consistent messaging about the program, how to get there, and why the County needs each stakeholder's support will be paramount. Section 8.2 of MDE's Zero Waste Maryland plan establishes an initiative to "Provide funding to local governments for outreach activities." The County could take advantage of grants or funding MDE makes available to assist local governments and grassroots organizations with their outreach activities.

The County already has a communication and outreach plan for promoting existing solid waste programs and services. Evaluating/auditing the current plan is a good basis for crafting the zero waste communications plan to residents and businesses. The County will want to evaluate/audit the communications plan on a regular basis to ensure the messaging remains clear and effective.

The County could consider expanding its use of social media in order to promote zero waste. The use of Facebook, Twitter, You Tube, and Instagram are all social media outlets that can be utilized to reach stakeholders. Promotion of zero waste to stakeholders that do not use social media should include mailings, radio/television advertisements, flyers/brochures at public places and other outlets as necessary.

The County must establish a well-designed website dedicated to the zero waste goal. This website can serve as the go-to place for all information about the County's programs and

initiatives to minimize waste. The website would be a resource for stakeholders in the County providing them with information on how to manage materials that they generate. The County could link their website to local organizations, such as Community Forklift, homeowner associations, and grassroots organizations that can help residents and businesses reduce, reuse, or recycle materials.

Table 10. Value of Material Commodities Disposed of at the Brown Station Road Sanitary Landfill in 2015

	Material Components	Annual Tons [1]	Average Market Price ($/ton) [2]	Market Value	Avoided Disposal Fee [4]
Recyclable Paper	Newspaper/print	7,000	$43	$297,500	$413,000
	Corrugated Cardboard	15,000	$101	$1,518,103	$885,000
	Magazines/Catalogs/ Other Books	3,300	$101	$333,983	$194,700
	Kraft Paper/Paperboard	8,400	$49	$412,034	$495,600
	Office Paper/Junk Mail/Misc. Paper	16,300	$158	$2,577,086	$961,700
	Aseptic/Wax Coated Paper [3]	4,900	$28	$135,220	$289,100
	Subtotal	**54,900**	**$96**	**$5,273,927**	**$3,239,100**
Recyclable Containers	PET (#1) Bottles	5,700	$233	$1,328,056	$336,300
	HDPE (#2) Bottles	2,900	$520	$1,506,673	$171,100
	Other (#3-#7) Bottles	200	$21	$4,104	$11,800
	Jars, Jugs, Tubs, Trays	3,800	$21	$77,984	$224,200
	Flower Pots	200	$21	$4,104	$11,800
	Other Rigid Plastic	6,400	$36	$233,143	$377,600
	Ferrous Cans	2,700	$42	$114,075	$159,300
	Aluminum Cans/Foil	2,500	$63	$157,973	$147,500
	Glass Bottle/Jars	9,300	$0	$0	$548,700
	Subtotal	**33,700**	**$102**	**$3,426,111**	**$1,988,300**
TOTAL		**88,600**	**$98**	**$8,700,038**	**$5,227,400**

1 Based on estimated tons disposed annually from Table 7.

2 Based on average price index for 2015 from RecyclingMarkets.net for NE USA

3 Based on national average price index for 2015 from RecyclingMarkets.net

4 Based on current landfill tipping fee of $59 per ton

Develop Zero Waste Curriculum in the Schools

Educating the youngest stakeholders in the County – schoolchildren – could be a top priority of the County to minimize waste over the long term. Prince George's County already has adopted a recycling plan for the schools and facilities under the jurisdiction of the County's Board of Education. The recycling program diverts many tons of materials annually from these facilities.

With nearly 130,000 children enrolled[14], a curriculum that complements the existing diversion program in the schools and educates them on waste minimization is important.

A comprehensive, hands-on learning experience whereby students' formal classroom education includes information on source reduction, waste diversion, and the County's zero waste goal could change the current mindset in the County. Complementing the classroom instruction, students could continue to take trips to various County solid waste facilities so they can see first-hand what happens to materials generated in the County.

Several organizations have an established curriculum that highlights the elements of a zero waste program including:

- The Maryland Association for Environmental and Outdoor Education (maeoe.org),
- The Alice Ferguson Foundation (fergusonfoundation.org/trash-free Potomac-watershed-initiative/education/trash-free-schools/), and
- The Story of Stuff (storyofstuff.org/resources/high-school-curriculum-buy-use-toss/).

Active Participation

Part of the hands-on experience with this curriculum is for students to take an active role in managing the recycling and waste reduction efforts at their school. Students can take turns collecting recyclables from classrooms and depositing them in centralized collection containers. They can identify opportunities for reducing or eliminating waste in their school as well. While such an experience and curriculum might look different from one school to the next, providing a framework and structure for formal education would afford students the opportunity to learn about zero waste and why the County is pursuing such a goal. Waste Management Division staff could meet with educators in the school system to discuss ideas for expanding education on resource management and work to identify or develop a curriculum that could be used across schools in the County.

The County could also consider establishing a program whereby schools are honored for their waste reduction and recycling programs. Such a program could have a competitive element to it whereby schools compete against each other to receive an award or recognition for their success.

Technical Training

At the high school or college level, the County could consider partnering with schools and the Building Materials Reuse Association to establish a program that trains students in building deconstruction practices and design for disassembly. As recommended in this plan, establishing a diversion ordinance for construction and demolition debris will require more careful deconstruction and disassembly of structures in order to increase reuse and recovery of these materials. This may boost the need for professionals with expertise in building deconstruction.

[14] Prince George's County Public Schools (PGCPS), student enrollment 128,937, accessed vis http://www1.pgcps.org/factsandfigures

Facilitating an educational program whereby students are educated about building disassembly and demolition will provide skilled professionals that specialize in this trade.

TARGET ORGANICS FOR DIVERSION

The organic fraction of the waste stream represents a significant opportunity to increase diversion and achieve zero waste. According to data from the Waste Characterization Study conducted in 2015, approximately 81,300 tons of compostable materials are buried at the landfill annually which includes:

- 44,700 tons of food scraps
- 19,800 tons of compostable paper (low grade paper such as napkins, tissues, and paper towels), and
- 16,800 tons of leaves, grass, and brush (disposed mostly by residents in trash collected curbside).

The County has been composting yard trimmings at their Western Branch Composting Facility for about 25 years. Under an intergovernmental agreement, the Maryland Environmental Service (MES) operates the Western Branch Composting Facility as well as the composting facility for Montgomery County. Compost produced through these two facilities is sold as Leafgro™. Demand for the product is high: the County sells out of Leafgro every year[15]. About 8,000 tons of yard trimmings and food scraps from Prince George's County are composted annually.

In May 2013, the County initiated a food scraps composting pilot program using the Gore® cover technology. Food scraps are mixed with yard waste in a 1:1 ratio and then ground to three inches or less. The mix is placed over aerated channels on a concrete pad and wrapped in a Gore® cover and monitored daily using a computerized system. The curing process using this technology takes about ten weeks from start to finish (eight weeks of active composting with two weeks of curing) instead of the current eight month cycle time currently used to compost yard trimmings[16].

Once finished, the compost is screened and sold in bulk as "Leafgro Gold." It is a little higher in nitrogen than Leafgro[17].

The County received a $12,000 grant from the US Environmental Protection Agency which covered about eight percent of the startup costs. Up to 125 tons per week of separated food scraps from both residential and commercial sources are processed along with soiled or waxed corrugated cardboard and some paper products. The pilot project included food delivered from the University of Maryland, the cities of University Park and Takoma Park, and several commercial haulers with specialized food collection routes (Apple Valley, Progressive Waste Solutions, and Compost Crew).

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15 "Turning food scraps into 'gold'", Washington Post, August 22, 2015.

16 "Prince George's County & MES Cut Ribbon on New Food Scrap Composting Project at Western Branch Yard Waste Composting Facility", MES Wave, the official blog of Maryland Environmental Service, October 2013.

17 "Food Scraps Composting At County Yard Trimmings Site", BioCycle May 2015, Vol. 56, No. 4, p. 21

Expand Organics Recovery and Foster Infrastructure Development

The County is considering expansion of the Western Branch Composting Facility to accommodate increasing interest from institutions, businesses, and residents that want to compost their food scraps, up to 32,500 tons per year.

In addition to expanding capacity for additional composting at the Western Branch Composting Facility, the County could consider establishing a network of smaller composting sites, often referred to a decentralized composting network. Decentralized composting networks can reduce the carbon footprint of collection and transportation and can be customized to localized situations without requiring large capital investment in equipment. The City of Austin, Texas has recognized the value of a decentralized composting network and as a result, the City has adopted a highest and best use philosophy for city collection programs of residential food scraps to guide its planning and has initiated the following new programs:

- Expanding its home composting incentive program to encourage the development of home and onsite composting; and

- Establishing composting trainings at community gardens and implementing a junior composter and master composter training program[18].

Decentralized composting networks tend to be smaller and less mechanized. The County could benefit from both centralized and decentralized composting systems as their characteristics, presented in **Table 11**, are complementary.

There is significant support at the State level for increased composting through House Bill 817 entitled *Environment – Composting* (Chapter 363, Acts of 2011). As a result, MDE convened a Composting Workgroup that included representatives from the Maryland Department of Agriculture, MES, the composting industry, local governments, and other stakeholders. The final report from this workgroup included recommendations to reduce barriers to responsible composting at the state level. Some of these recommendations are appropriate for County involvement such as:

- **Financial Assistance** – The County could help secure financing for local businesses interested in providing services to increase composting of organics, including[19]:

  - Private haulers that specialize in food scrap collection
  - Equipment to mitigate odors (the reason many composting facilities are closed)
  - Testing services for finished compost that many small sites cannot afford
  - Collection bins

- **Training and Staff** – Smaller neighborhood composting systems need staff to process organics and turn windrow piles as well as training of staff to make quality compost.

[18] City of Austin, Resource Recovery Department, The Austin Resource Recovery Master Plan, December 2011.

[19] Brenda Platt, Institute for Local Self Reliance, "State of Composting in the US: What, Why, Where & How", presented at the 2015 Annual Conference of the Maryland Recycling Network

ECO City Farms is an educational, non-profit organization located in the County designed to serve as a prototype for sustainable local urban farming. At their Edmonston Farm, they accept local food scraps for composting and vermicomposting in addition to providing training on composting at the beginner, advanced, and master composting levels. The County could work with other local farms to expand a composting network and use ECO City Farms as its model.

Table 11. Centralized versus Decentralized Compost Programs[20]

	Centralized	Decentralized
Labor and Technology	• Less manual labor • Higher skill level required	• Lower startup costs • More labor intensive
Operation, Maintenance, and Transportation Costs	• Higher operations and maintenance costs • Higher transportation costs to deliver and to distribute	• Could be difficult to find land in urban areas • Lower transportation costs
Citizen Involvement and Employment	• Job opportunities for higher skilled professionals	• More neighborhood involvement and interaction with compost process • Finished compost more accessible for residents • Job opportunities for low-skilled, low-income residents
Compost Quality	• Professional management more likely to avoid problems such as odor, leachate, or vectors	• More pre-screening of materials leads to less contamination • More labor intensive

An example of how the County can ramp up its composting program is the following continuum of composting options. These would include:

- **Backyard Composting:** providing bins and training on how to use them.
- **Neighborhood or Community Garden Composting:** Several households could share a centralized composting bin and receive training on composting practices.
- **Distributive Network in a Community:** A series of bin systems are shared by a larger group of households (about 40). Residents organize themselves to mix and process food scraps, turn compost piles, and screen piles at the end of the process before the finished compost is distributed.
- **Municipal Composting:** A town/city sets aside land for food scrap and yard waste composting within town/city limits, using city staff (or contracted employees to mix and process, turn compost piles, and screen piles).

[20] Grace Grimm, "Centralized vs. Decentralized Composting", SFGate.com (sister-site of the San Francisco Chronicle)

- **Institutional Composting:** Schools, colleges, government facilities, prisons, and other institutions that generate sufficient organic materials use their staff and land for composting operations but receive training and other resources that encourage composting.

- **Multi-Town/City Collaborative:** Four or more towns/cities would do curbside collection and transport the food scraps and yard trimmings to a regional site (or farm) where the materials are composted by a certified facility operator. This avoids long drives (fuel, staff time) to a central location.

- **Centralized Composting at Western Branch Composting Facility:** Where sufficient material is consistently set out and collected to warrant transportation to a centralized facility.

Each of these composting options would need a situation-specific plan that addresses collection methods, costs, training, composting practices, resources, staffing, metrics, and reporting. The County's role in expanding the existing composting infrastructure could include the following:

1. Identify smaller more localized composting sites,

2. Facilitate the permitting process for these smaller more immediate composting facilities.

3. Help fund equipment and staff required by decentralized operations.

4. Provide technical assistance to residential, municipal, educational, and commercial stakeholders as they set out to develop their composting capabilities and capacities.

5. Pass ordinances that require food waste and other compostables to be recovered.

6. Increase education and awareness.

Mandatory Diversion of Food Waste from Commercial Properties

Efforts to require all commercial generators within the County to separate food waste from the materials they generate at their business could potentially divert over 12 percent of the commercial waste stream. To effect this change, the County will need to develop and adopt an ordinance that requires waste generators to source separate food waste from other waste, and set the organics out for collection. Consideration could also be given to provide for the composting of soiled paper products which has the potential to divert an additional 7.3 percent of the commercial waste stream.

For such a policy to be feasible, the County must first establish the infrastructure to accommodate increased composting. The relative lack of existing infrastructure to support composting in the Region means considerable time and money will be required. Such infrastructure is required in order to divert the compostable portion of the waste stream. Once the infrastructure is established and the resources have been allocated to successfully manage

compostable materials, the County could require the source separation and diversion of food waste from commercial generators.

Jurisdictions have implemented disposal bans for commercially generated food waste. The Massachusetts Department of Environmental Protection (MassDEP) instituted a statewide ban in 2014 of food waste for businesses and institutions that dispose of one ton or more of these materials per week. In conjunction with the ban, the MassDEP launched an education and outreach program that provides guidance for entities impacted by the ban. Businesses are encouraged to reduce and donate excess food as a starting point. The State also assists in setting up a diversion program by providing food waste best management practices and tips on finding haulers and facilities where food waste may be disposed.

The County's priority should be to first encourage donation of edible food for consumption by humans before diverting food scraps to a composting program. The County could identify major food waste generators and seek to pair them with organizations/charities for food donation or local farmers that can use food waste in livestock production. Information on food waste generators and potential donation and reuse opportunities could be listed on the County's website.

Residential Food Waste Collection Programs

Once the commercial food waste diversion and composting programs are implemented, the County may consider implementing residential food waste collection and composting. It would involve residents separating organic materials from other waste they generate at their homes, and place it in a container for separate collection. According to a 2014 survey by BioCycle, 198 communities have a curbside food waste collection program[21]. Of the three communities in Maryland with such a program, the Town of University Park is the only one in Prince George's County.

The Town of University Park's curbside food waste collection program began in 2011 and has expanded to serve nearly 20 percent or 200 households in the Town. The Town provides residents with a kitchen pail, compostable bags, and a five-gallon bucket for the food waste. Food waste is collected weekly and delivered to the County's Western Branch Composting Facility. The Town collects the bagged food waste in dump-body trucks. The initial program was funded through a $15,000 federal energy grant. Equipment and labor expenses for operating the program are paid for by the Town's Public Works Department. According to Mickey Beall of the Town of University Park, interest in the program continues to grow, and the program has diverted about 88 tons of food waste in the last four years[22].

Food waste comprises over 17 percent of the residential waste stream in the County. If the program were to include compostable paper, an additional seven percent of the waste stream could be diverted, making nearly a quarter of the residential waste stream eligible for capture as part of a residential organics collection program. As discussed above, there needs to be adequate composting infrastructure to accommodate the diversion of these materials.

[21] BioCycle Nationwide Survey: Residential Food Waste Collection in the U.S., 2015. www.biocycle.net

[22] Beall, Mickey, Town of University Park, MD. Personal communication, February 22, 2016.

The County could support the existing Town of University Park municipal food waste collection by providing a reliable long-term composting facility for the management of food waste and organics. Once additional composting capacity has been established, the County could encourage other incorporated municipalities to establish residential food waste collection programs and possibly provide grants, equipment, and staff to assist in the implementation of such programs. Also, the County could implement a full-scale program whereby food waste is collected with yard waste as part of existing County contracts with waste haulers.

INCREASE DIVERSION OF CONSTRUCTION & DEMOLITION DEBRIS

Construction and demolition (C&D) debris represents a sizable share of the County's waste stream. About 31 percent of the waste disposed in the County is considered C&D debris[23]. These materials are disposed at multiple private facilities in and outside the County: the landfill does not accept C&D, unless it originates from a county residence and is delivered by the property owner[24]. Only one pick-up truck-sized load is allowed per year. Diversion of these materials through recycling and reuse programs represents a significant opportunity for the County to reduce disposal of these materials. Policies and programs that encourage these materials to be recovered could be implemented once markets for materials are identified.

Cooke County, Illinois, recognizing the significant amount of waste generated from C&D projects, has established an ordinance to divert C&D materials from the waste stream. Under their ordinance, applications for a demolition permit are subject to two requirements:

1) Any residential building is subject to a reuse requirement of five percent by weight and a diversion requirement of 70 percent by weight; and

2) Any non-residential building is subject to a 70 percent by weight recycling requirement with reuse encouraged whenever possible.

The Cooke County ordinance necessitates the completion of a demolition debris diversion plan for each project. The plan must outline how the requirements of the ordinance will be met and include diversion estimates, transportation means, and the destination(s) of the demolition debris.

The County could establish and promote a C&D waste diversion goal and provide guidance to local contractors about best practices for segregating materials and available markets for segregated materials. Contractors could be recognized for their projects that diverted significant quantities of material from disposal. The County could lead by example by following the same requirements and meet the same standards they set for outside construction and demolition projects.

Entities seeking construction and demolition permits from the County could be required to complete a waste management plan as part of their application process, which would include the following:

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[23] Prince George's County Maryland Comprehensive Ten-Year Solid Waste Management Plan, 2017

[24] https://www.princegeorgescountymd.gov/615/Brown-Station-Road-Sanitary-Landfill

- Estimated volume or weight of waste generated from the project by material type;
- Estimated volume or weight of materials that can be diverted for reuse or recycling;
- Vendor the applicant will use to haul the materials;
- Facility(s) the materials will be brought to;
- Estimated volume or weight of materials that will be disposed.

To hold entities accountable for complying with their waste management plan, the County could establish a "diversion deposit." The amount of the deposit could be based on the size of the project. The deposit could be returned to the applicant upon proof that no less than the required amount of waste diverted was recycled or reused. An applicant would only receive a portion of their deposit back that is proportional to the amount of material diverted below the set required level. An applicant who fails to comply with the diversion requirements would forfeit their deposit completely.

Additionally, demolition projects could be made available for deconstruction, salvage, and recovery prior to demolition. A set period of time could be established from when an applicant receives the approved demolition permit from the County to when demolition may actually begin. Such a requirement will give entities the opportunity to recover the maximum amount of recyclable and reusable materials prior to demolition.

IMPLEMENT PAY-AS-YOU-THROW (PAYT)

In Pay-As-You-Throw (PAYT) programs, residents pay directly for waste collection services based on the amount of waste they throw away, similar to the way they pay for electricity, gas, and other utilities. When consumers pay for every bag or can of waste they dispose, they are motivated to recycle more and look for ways to prevent waste in the first place.

PAYT programs are not new. The United States Environmental Protection Agency (US EPA) reported in 2006 that over 7,100 US communities use PAYT programs, including 30 percent of the largest US cities[25]. The County could explore the economic and operational viability of PAYT. Further details of PAYT as follows:

PAYT Program Structure

PAYT program usually target residential waste and can be used with bags, stickers, or waste collection containers. The type of PAYT program chosen is generally dependent on local conditions. There are three main types of PAYT programs.

- **Full-Unit Pricing** – residents must purchase bags or stickers in advance and only waste in approved containers will be collected;

- **Partial-Unit Pricing** – residents are provided a certain number of bags or stickers for their waste that is included for collection with their taxes. Additional bags or stickers must be purchased if the resident produces more waste than is covered.

[25] Skumatz, L. A. and Freeman, D. J. (2006). Pay As You Throw (PAYT) in the US: 2006 Update and Analyses. Prepared for U.S. EPA by Skumatz Economic Research Associates, Superior, CO.

- **Variable-Rate Pricing** – residents choose a particularly-sized cart based on the amount of solid waste generated. The smaller the cart the cheaper the disposal cost. When implementing such a variable-rate system, the per unit cost should not be reduced for larger volume carts.

Larger communities and urban and suburban communities tend to use carts especially if they have automated collection. Smaller communities and more rural communities are more likely to use bag and sticker programs. The structure of PAYT programs for U.S. communities of varying sizes and geographies are presented in **Table 12**.

Table 12. US Communities with PAYT Programs

Community	Population	Year PAYT Initiated	Structure of PAYT Program
Aberdeen MD	15,612	1993	Sticker System
Attleboro MA	43,837	2005	Hybrid Bag System
Dubuque IA	58,155	2002	Hybrid Bag/Tag System
Boulder CO	101,800	2001	Variable Cart System
Minneapolis MN	392,880	1989	Hybrid Cart/Bag System
Oakland CA	400,740	1985	Variable Cart System
Sacramento CA	475,526	1995	Variable Cart System
Fort Worth TX	777,992	2003	Variable Cart System with Private Haulers
Austin TX	842,592	1992	Variable Cart System
San Jose CA	982,765	1993	Variable Cart System

PAYT Benefits

In 2006, the EPA reported that on average, communities that implement PAYT programs reduce their solid waste disposal by 17 percent. About one-third of this decline is attributed to increased recycling, one-third is attributed to increased composting, and one-third attributed to residents reducing the quantity of waste generated. More recently, EPA highlighted the results of a study conducted by Green Waste Solutions titled, "Unit Based Garbage Charges Create Positive Economic and Environmental Impact in New England States" in their PAYT Summer Bulletin. This study found that when residential waste is actually isolated and measured on a per capita basis, PAYT communities generate about 49 percent less waste than those leaving the cost of trash in the tax base or in a fixed fee. Communities with a PAYT program disposed an average

of 467 pounds per capita per year compared to 918 pounds per capita in the non-PAYT communities.

Based on the range of waste disposal reductions reported by these two studies, implementation of a PAYT program in Prince George's County could reduce residential waste disposal between 35,000 and 102,000 tons per year, Environmental benefits of PAYT are an annual reduction in greenhouse gases of between 22,300 and 64,300 metric tons of carbon dioxide equivalent. This equates to greenhouse gas emissions (reported by EPA WARM model) of between about 22,300 and 64,300 vehicles annually (see **Table 13**).

PAYT Service Fees

Most communities structure rates so that higher waste volumes result in higher monthly fees to the residential households. Proportional or linear rates charge customers for each bag or each gallon of trash capacity used. For example, a municipality that offers a proportional rate may charge $20 a month to collect trash from a 32-gallon cart and $40 a month to collect trash from a 64-gallon cart – each rate is the equivalent of $1 per gallon. A variable rate structure does not charge a uniform cost per bag or gallon. For example, Oklahoma City, OK contracts trash collection for 117,000 households and charges $19.73 per month for one or two 96-gallon carts – there is no additional charge for using two carts instead of one. Some communities escalate the fee sharply for households that dispose greater quantities of trash. For example, Austin, TX charges its residents a base fee of $13.05 per month for collection in addition to $0.16 per gallon. However, residents using a 96-gallon cart for trash collection are charged $0.30 per gallon. In general, a proportional rate structure or a variable rate structure that increases as the volume of trash increases is more likely to reduce the quantity of trash disposed.

Table 13. Estimated Waste Reduction, Disposal Cost Savings, and Greenhouse Gas Emission Reductions from PAYT in Prince George's County

Economic Impacts and Environmentla Benefits	Residential Waste Disposal			
	Current	17% Reduction [1]	35% Reduction	49% Reduction [2]
Annual Residential Waste Disposal Quantity				
Landfilled Tons	208,000	172,640	135,200	106,080
Waste Reduction		35,360	72,800	101,920
Number of Households Serviced by County Contractors	158,000	158,000	158,000	158,000
Per Capita Disposal (lbs/person/year) [3]	940	780	611	480
Economic Impact of PAYT				
Avoided Landfill Tipping Fees		$2.1M	$4.3M	$6M
Environmental Benefits				
Greenhouse Gas Reductions by Recycling instead of Wasting				
Annual Greenhouse Gas Savings (MTCE) [4]		33,500	68,900	96,500
Equivalent to Annual Emissions by This Number of Cars		22,300	45,900	64,300

1 Average residential waste reduction according to EPA (2006)

2 Average residential waste reduction according to "Unit Based Garbage Charges Create Positive Econoic and Environmental Impact in New Englad States" by Green Waste Solutions.

3 Assumes an average household size of 2.8 persons, US Census Bureau, State and County Quickfacts

4 Greenhouse gas estimates based on one-third of waste reduction tonnage diverted for recycling instead of landfil. According to EPA's Clean Energy website, each ton of waste recycled saves 2.87 metric tons of CO2

The cities of San Jose and Oakland, California, and Austin, Texas, distribute the entire cost of the solid waste program (administration, public education, collection, and disposal) by the size of the trash collection cart as shown in **Table 14**.

Table 14. Selected Communities with Proportional or Escalating PAYT Rate Structures

City	Monthly Cost per Household	
	96-gallon Cart	32-gallon Cart
San Jose, CA	$89.85	$29.95
Oakland, CA	$98.44	$29.30
Austin, TX*	$41.85	$18.15

* Both 96-gal and 32-gal fees include base fee of $13.05 in addition to $0.16 per gallon for 20-, 32- and 64-gal carts but $0.30 per gallon for 96-gallon carts.

Develop a PAYT Implementation Plan

Because PAYT charges more for increased waste disposal, some residents will be assessed a smaller fee for service but others will be assessed a larger fee. Suggesting a change to the current system could be met with strong public opposition, especially from those who will be

required to pay increased fees. Therefore, the public must be involved in the process that ultimately structures the new system. The County could provide residents with information about the purpose of the change, what the County hopes to achieve through the change, and how the new program will work. Implementation involves the following actions:

1. **Assess set-out rates** – The County could estimate how much trash is currently set-out per household on average. This could be the number of bags or cans per household.

2. **Work with contract haulers to identify PAYT program structure** – The County could meet with their contracted haulers to get their input on the type of PAYT program that would work best for the County (bags, stickers, carts, or a mix).

3. **Decide on fee structure** - The fee structure will need to cover the cost of the waste and recycling collection system including administration, collection, public education, and disposal. Additionally, the number and sizes of containers will need to be decided. For example, will all residents be offered a choice of a 32-, 64-, or 96-gallon containers?

4. **Develop a public education campaign** – The new PAYT structure will need to be promoted to the residents. Residents could be kept informed of the need for the PAYT program and how it will operate. The County could use a multitude of media to promote the new PAYT program (social media, website, signs, brochures, letters or presentations to civic groups and HOAs, etc.).

5. **Develop a campaign to prevent illegal dumping** – An increase in waste collection fees could increase illegal dumping. Procedures could be developed to identify and report and prevent illegal dumping.

6. **Develop a method to annually assess the impact of the PAYT program** – The County may want to benchmark the quantity of trash collected and disposed of at the LANDFILL from county-contracted haulers, the average annual quantity of trash generated per household serviced, the quantity of recyclable material collected from households in the PAYT program, and the average annual quantity of recyclables generated per household serviced.

Implementation Costs

Capital costs for PAYT implementation were estimated based on a variable-size cart program structure. Assuming that 20 percent of current households receiving county-contracted waste collection services will want a second cart, the capital investment in the program is estimated in **Table 15**.

Table 15. Estimated Capital Cost for Variable Sized Cart PAYT Program

Number of Households Serviced by County-Contracted Haulers	158,000
Number of Carts [1]	189,600
Cost per Cart	$40
Total Cost	$7.6M
Monthly Cost per Household [2]	**$0.51**

1 Assumes one cart per household with up to 20% of households receiving a second cart

2 Monthly cost per household based on amortization of capital costs at 5 percent interest over 10 years.

Similar to variable sized cart programs, costs for bag programs will need to assess the type and size of pre-printed bags, retail distribution of bags, and administrative and public education programs.

EXPAND EXISTING RECYCLING REQUIREMENTS

The County has adopted a number of regulations and policies that increase recycling in different generating sectors. While these initiatives are important for diverting waste materials, there remain opportunities to expand and tighten these requirements to minimize waste materials and measure their success.

Evaluate Single-Family Residential Recycling Programs

Prince George's County manages 30 waste collection contracts involving 20 private waste collection haulers for service to about 158,000 households. The County could track quantities of trash and recyclables collected in each of its contracts to assess areas where increased education and outreach are needed. The City of Sioux Falls, South Dakota, rewards waste collection haulers that exceed their recycling goal with rebates and penalizes haulers that fail to recycle enough by applying surcharges to their waste loads tipped at the County landfill. The City also publishes the recycling rates of its licensed haulers on its website[26].

The residential recycling rate in the County is low, compared to its commercial recycling rate. While the County's overall recycling rate in 2015 was 59.5 percent, the recycling rate for the residential sector is only about 34 percent. The County should examine to what extent are households aware of and correctly following the guidelines on recycling.

Encourage Multi-Family Recycling

The State of Maryland and Prince George's County require owners of multi-family rental facilities and condominiums to provide facilities that allow tenants to voluntarily recycle designated materials. The County identified 232 apartment buildings and 97 condominium

26 https://www.siouxfalls.org/public-works/environmental-recycling-hazardous/hauler-recycle-rates.aspx

buildings that are impacted by the law[27]. The County could provide continual guidance and assistance on:

- **Convenient Placement of Recycling Collection Containers** – Residents of multi-family dwellings will recycle greater quantities more often if the collection containers are conveniently located. For example, high rise apartments could have a recycling collection container on each floor and garden apartments could have recycling collection containers in the basement or near their building (less than 200 feet from the building's door).

- **Adequate Collection Container Capacity** – Residents of multi-family dwellings are more likely to recycle if the recycling collection containers have adequate capacity. Since the County is striving for high diversion, the capacity of the trash and recycling containers could reflect the County's goals. For example, recycling capacity could be at least the same or more than trash capacity, which would reflect a recycling rate of 50 percent or more

- **Signage** – The transient nature residents in multi-family dwellings means that continual education about recycling is required. The County could help develop consistent signage for multi-family residents on items allowed in the recycling collection containers.

Montgomery County developed a document titled *Property Manager's Guide to Recycling and Waste Reduction at Multi-Family Properties* to provide specific guidance on how to set-up an effective multi-family recycling program. Prince George's County could consider developing a similar document to assist with setting up diversion programs at multi-family properties. The document could also contain information and tips on how residents can reduce the amount of waste they generate.

The County requires owners of multi-family properties of 100 or more units to submit a plan for the separation and collection of recyclable materials[28]. Lowering the threshold for requiring a plan to 25 units would increase the quantities of recycling and facilitate the County's opportunity to track recycling programs at multi-family buildings. County staff could review each plan and conduct follow-up site visits to ensure the plans are being properly implemented and whether there are opportunities for improvement.

The County requires property owners to submit an annual report to document the collection methods, quantities, and disposal location of recyclables diverted from the waste stream as well as waste removal quantities. The County could track this data and use it to develop mandatory diversion requirements that incrementally increase for multi-family properties. Likewise, enforcement of these mandatory recycling requirements is needed.

Since 2011, Arlington County, Virginia, requires multi-family properties with three or more units to submit a recycling plan to the County with an updated plan every three years. The City of Austin, Texas, passed the Universal Recycling Ordinance which requires that all multi-family

[27] Prince George's County Maryland Comprehensive Ten-Year Solid Waste Management Plan, 2017
[28] Prince George's County, Maryland Comprehensive Ten-Year Solid Waste Management Plan, 2017, Appendix E.

properties submit an Annual Diversion Plan between October 1 and February 1.each year. The reporting requirements are being phased in: larger properties first followed by smaller properties. Multi-family properties with 50 or more units were required to file an Annual Diversion Plan by February 1, 2014. Eventually all multi-family properties will be required to report diversion by February 1, 2018[29].

The County should develop baseline information about the current level of recycling in multi-family properties. Continued monitoring on the quantity of waste disposed and recycled from multi-family properties should be documented to assess progress toward the County's zero waste goals.

Expand Commercial Recycling

Similar to the recycling requirements at multi-family residents, owners of commercial and industrial properties must provide facilities to allow employees, tenants, and customers to voluntarily recycle. The County's law requires the owners of these covered properties to complete and submit annual reports identifying the quantities and types of recyclable materials collected through the program. County staff needs to use this data to track the progress of the commercial recycling program. It is recommended that the law be modified to require recycling of materials rather than simply requiring property owners to provide employees and tenants with facilities to voluntarily recycle. Owners would still be required to submit reports on quantities of materials generated and diverted. By obtaining and tracking this information, the County can direct resources and staff to provide assistance to businesses that are not meeting diversion requirements. Other municipalities with mandatory commercial recycling include:

- Montgomery County, Maryland
- City/County of Sacramento, California
- City of Austin, Texas
- City of Philadelphia, Pennsylvania
- City of Portland, Oregon

The County's current commercial recycling ordinance indicates that owners of properties may request technical assistance or grant funding from the County. It is recommended that the County's outreach and support services become more proactive to businesses rather than relying on businesses approaching the County for assistance first.

The County could take the following steps to increase recycling in the commercial sector:

1. **Mandatory Recycling –** The County could require mandatory commercial recycling through updated ordinances and increased enforcement. In 2012, the City of Austin's Universal Recycling Ordinance (URO) went into effect. Initially, commercial properties such as office buildings, medical facilities, religious buildings, and private education facilities were required to recycle according to the following phased in approach:

    - 2012 - Properties with >100,000 square feet;

[29] http://www.austintexas.gov/uro

- 2013 - Properties with >75,000 square feet;
- 2014 - Properties with >50,000 square feet; and
- 2015 - Properties with >25,000 square feet

2. **Outreach and Education Specific to Business -** Each year, the City of Napa, California, determines its 25 largest commercial trash generators and automatically audits their waste composition in an effort to reduce trash and increase recycling. These businesses receive an in-depth analysis of what could be recycled and how to set up a system to capture all recyclables on-site[30]. Other municipalities that offer audit services to their businesses include Whitman County, Washington, and Los Angeles County, California.

3. **Grants –** In Hennepin County, Minnesota, commercial buildings that generate four cubic yards or more of trash per week must recycle at least three materials by 2016. The County offers grants, signage, technical assistance and case studies to help business and organizations start or improve recycling programs[31].

4. **Reduce Financial Burden** – When Montgomery County, Maryland, identified the cost for recycling collection services as a major obstacle for increased recycling in the commercial sector, they assisted smaller businesses in urban settings develop cooperative collection programs. For these programs, groups of small businesses within close proximity share a single contract for both trash and recycling collection services; thus removing the financial burden of recycling. Prince George's County could identify businesses without recycling collection services and assess if a cooperative program would help them establish a recycling program.

5. **Commercial Recycling Bin Legislation** – The County could require that businesses place recycling bins next to trash bins to encourage employees and customers to recycle.

Increase Special Event Diversion Opportunities

The County could work to expand reuse, recycling and composting at all special events that meet the criteria listed in Maryland General Assembly Senate bill 781. A special event organizer is required to provide recycling opportunities at events that meet the following criteria

- Temporarily use public streets, facilities, or parks;
- Serve food and beverage;
- Host more than 200 people.

There is little information on the awareness, compliance, or effectiveness of the recycling requirement at special events. The County could develop materials on zero waste event planning and a database of caterers that can provide zero waste event catering. In order to get a better handle on waste diversion at special events, the County could require event organizers to submit documentation of waste generation and diversion. This requirement will help the County better

30 Institute for Local Governance website, www.ca-ilg.org/post/napa-audits-business-waste-boost-recycling

31 Hennepin County, MN website, www.hennepin.us/businessrecycling

understand waste management at special events and allow them to require additional actions in order to divert more materials.

The County could also expand on this state law to address recycling and diversion from vendors that sell goods or services at these events. Vendors and suppliers attending special events often produce materials that are discarded "behind the scenes" of special events. This is usually cardboard, but can include recyclable containers, mixed paper, and food waste. The County could require large containers for recycling that are easily accessible to vendors at the special events.

The law currently states that the event organizer may assess the availability of food scraps recycling services for the event. Special events that meet the above criteria could be required to separate compostable food waste from recyclables and trash streams at the event. Food waste can represent a significant portion of the waste stream of special events.

The City of Greenbelt hosts two large special events, the Labor Day Festival and Fall-Fest, where waste reduction and recycling initiatives are promoted. The City has recently experimented with a limited program for diverting food waste from these events. Volunteers staff recycling and composting stations to assist the general public in placing their materials in the right container. The logistics and staff requirements needed to reduce waste generation from special events are substantial. To support special event organizers with the recovery of food waste, the County could provide technical assistance, bins, and staff to help recover food waste.

LEAD BY EXAMPLE

Strategies for County Facilities

One of the most effective ways the County can demonstrate the importance of minimizing waste is by leading efforts to minimize waste from County facilities. Pursuing zero waste in County-owned facilities will highlight the importance of the goal to the community. It will also better position the County to assist businesses and residents in implementing their own waste minimization strategies, as they will be able to rely on their own experience in reducing waste. The initiatives undertaken and the results the County achieves in reducing solid waste can be used in educational materials and presentations to enhance their message to the community.

There are a number of ways in which the County could lead the charge in nearly eliminating waste:

- Conduct waste audits of County facilities.
- Eliminate use of bottled water.
- Locate recycling and compost containers next to each trash container at the County's facilities and on streets where there are commercial businesses.
- Identify County facilities where composting can occur on-site to minimize the transport of materials to other facilities.

- Use compost in all county landscaping and beautification projects.

- Expand County purchasing requirements with preference to products that contain recycled content or composted materials. Programs can incorporate specifications for Countywide building permits and contracts, and provide a preference to zero waste businesses for County, including green caterers and suppliers. Where no such green products exist or it is cost-prohibitive, the County could evaluate alternative products.

- Establish policy of purchasing locally-produced products whenever possible.

- Track and document the progress the County is making in eliminating waste and post the results on their website and communicate the results to the public.

- Properly recycle special waste materials such as electronics, florescent bulbs, used oil and other automotive products.

- Implement a rewards program for County employees and/or departments that minimize waste.

- Form an inter-departmental "green team" to provide leadership and support for zero waste across all County departments and facilities.

Port Towns EcoDistrict

The Port Towns of Bladensburg, Colmar Manor, Cottage City, and Edmonston form the Port Towns EcoDistrict. The EcoDistrict project has two chief goals:

- To be a regional leader in recycling, reuse, and repurposing of building and organic waste by transforming industrial space and creating a leading edge facility; and

- To help incubate and accelerate the development of green and sustainable businesses.

EcoDistricts strive for sustainable development and encourage energy and water conservation, health and well-being to its residents and businesses, and optimized materials management or zero waste strategies. Ways to incorporate zero waste goals into the development to the EcoDistrict include:

- **Minimizing use of virgin materials and toxicity of new products.** The EcoDistrict could encourage salvaged building materials in its development.

- **Maximize use of products made with recycled content.** This creates a market for recycled materials. Optimally a business in the EcoDistrict can use a waste product of a neighboring business or the community in its process. Example businesses could include mattress recycling, paint reuse and remixing, and repair shops.

- **Compost organic wastes.** The County could locate a small composting facility or neighborhood farm that composts food scraps, yard trimmings, and compostable paper generated in the EcoDistrict. A composting operation will create jobs also.

4 NEXT STEPS

The zero waste initiatives presented in the previous section have been implemented in various forms by other U.S. jurisdictions pursuing zero waste. Each jurisdiction has unique circumstances and politics that present its own challenges and solutions to reducing waste, diverting increased waste quantities from landfill disposal, and developing programs and infrastructure in a cost-effective manner.

The County could do the following in order:

1. Establish zero waste goals and an associated timeline for achieving those goals. Assess the goals and timeline periodically and adjust as necessary.

2. Prioritize cost-effective initiatives based on their cost and potential to reduce waste, for inclusion in a Zero Waste implementation plan.

3. Develop metrics that will be used to assess progress of the zero waste goals. Identify responsible parties for providing data and presenting metrics on a periodic basis.

4. Create a pilot program for some initiatives to provide data and information that will facilitate or modify full county implementation.

5. Assess costs related to piloting selected initiatives and implementing them full scale. Use estimated costs to budget sufficient resources for successful implementation.

6. Develop a detailed implementation plan for the selected initiatives.

7. Involve the public in the zero waste planning process.

8. Evaluate successes and challenges of implementing zero waste initiatives so that program expansion and implementation of other zero waste initiatives can benefit.

9. Incorporate new zero waste initiatives as technology or markets change.

The County currently maintains and updates its Ten Year Solid Waste Management Plan on a periodic basis. The County may want to incorporate zero waste planning into this document and/or the developing Resource Recovery Plan to be finalized in 2018.

Appendix A - Definitions

Bulky Waste	Large items of refuse including, but not limited to, appliances, furniture, large auto parts, non-hazardous construction and demolition materials, trees, branches, and stumps which cannot be handled by route compaction type collection vehicles, and also requires special processing and disposal methods.
Commercial Waste	Solid waste generated by establishments engaged in business operations other than manufacturing. This category includes, but is not limited to, solid waste resulting from the operation of stores, markets, office buildings, restaurants and shopping centers.
Construction and Demolition Debris (C&D)	Waste building materials, packaging, and rubble resulting from construction, remodeling, repair, and demolition operations on pavements, houses, commercial buildings, and other structures. Includes: roofing, piping, dry wall, wood, bricks, concrete and similar materials, but excluding asbestos containing materials.
Contaminant	Unwanted material that renders the other materials unacceptable to the user.
Diversion Rate	A measure of the amount of waste material being diverted for recycling compared with the total amount that was generated.
Convenience Center	A method of collecting recyclable or compostable materials in which the materials are taken by individuals to collection sites and deposited into designated containers.
HDPE (High Density Polyethylene)	A type of plastic, identified by the Society of Plastics Industry code number 2.
Household Hazardous Waste	Wastes from products purchased by the general public for household use which, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may pose a substantial known or potential hazard to human health or to the environment when improperly treated, disposed of, or otherwise managed.
Land Clearing Debris	Stumps, wood, brush, and leaves from land clearing operations.
Material Recovery Facility	A facility equipped with manual and/or automatic machinery to separate recyclable materials from mixtures to individual grades or types, in order to prepare them to market requirements.
Mulch	Ground or chipped wood and brush wastes.
Municipal Solid Waste (MSW)	Includes nonhazardous waste generated in households, commercial and business establishments, institutions, and light industrial process wastes.
Non-Ferrous Metals	Metals that are derived from metals other than iron and steel alloys in steel, including aluminum, copper, brass, bronze, lead, zinc, and other metals to which a magnet will not adhere.
Old Corrugated Cardboard (OCC)	Cardboard manufactured in multiple layers, with one or more inner layers consisting of a series of alternating ridges and grooves.
Other Plastics	All plastic resin types except polyethylene terephthalate (PET) containers, film plastics, and high density polyethylene (HDPE) containers.

Participation Rate	A measure of the number of people participating in a recycling program compared to the total number that could be participating.
PET (Polyethylene Terephthalate)	A type of plastic, identified by the Society of Plastics Industry code number 1.
Recycling	The result of a series of activities by which materials, that would become, or otherwise remain waste are diverted from the solid waste stream by collection, separation, and processing, and are used as raw materials in the manufacture of goods sold or distributed in commerce, or the reuse of such materials as substitutes for goods made of virgin materials.
Residential Solid Waste	Solid waste originating from single-family or multiple family dwellings.
Resource Recovery	A term describing the extraction and use of materials that are used as raw materials in the manufacture of new products, or the conversion into some form of fuel or energy source. An integrated resource recovery program may include recycling, waste-to-energy, composting, and other components.
Reuse	The use, in the same form as it was produced, of a material or product (such as a cardboard box) that might otherwise be discarded.
Solid Waste Management	The systematic administrative activities which provide for the collection, source separation, storage, transportation, transfer, processing, treatment, or disposal of solid waste.
Source Reduction	The design, manufacture, acquisition, and reuse of materials so as to minimize the quantity and/or toxicity of waste produced. Source reduction prevents waste either by redesigning products or by otherwise changing societal patterns of consumptions, use, and waste generation.
Waste Diversion	To divert solid waste from landfills or processing facilities, through reuse, recycling, or composting.
Waste Generation	The amount (weight or volume of the overall waste stream) of materials and products as they enter the waste stream before materials recovery, and composting takes place.
Waste Reduction	The reduction of the quantity, in pounds or tons, of material which becomes waste.
White Goods	Discarded, enamel-coated major appliances, such as washing machines, clothes dryers, hot water heaters, stoves, air conditioners, and refrigerators.
Wood Waste	Solid wastes consisting of wood pieces, or particles, that are generated from the manufacturing or producing of wood products, harvesting, processing, or storing of raw wood materials, or construction and demolition activities.
Yard Waste	Any waste generated from maintaining or altering of public, commercial or residential landscaping, including, but not limited to, yard clippings, leaves, tree trimmings, prunings, brush, and weeds.

Appendix B – Further Detail on Waste Characterization

Residential Waste

Exhibit 1 through **Exhibit 5** present breakdowns of the major residential waste categories by weight.

Exhibit 1. Residential Recyclable Paper By Weight

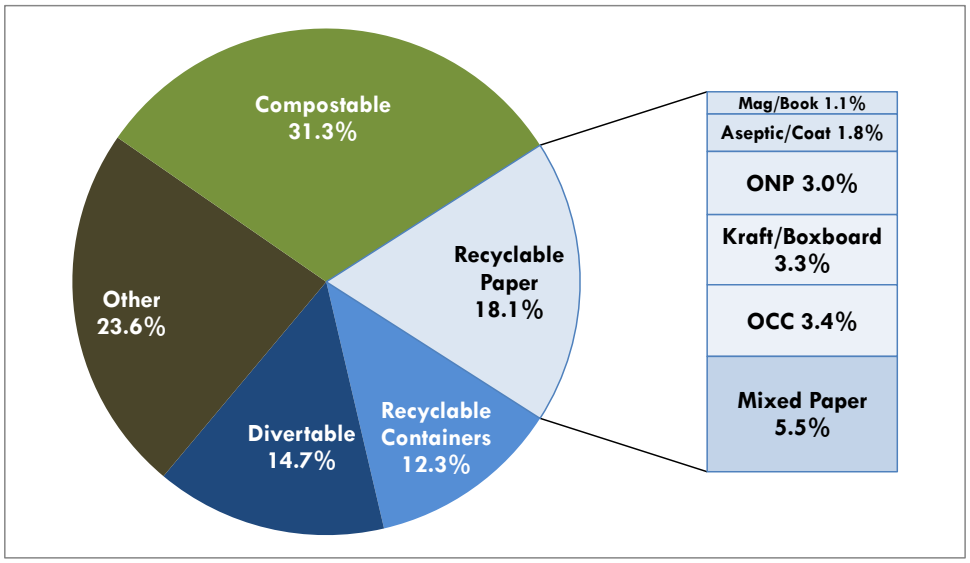


Exhibit 2. Residential Recyclable Containers By Weight

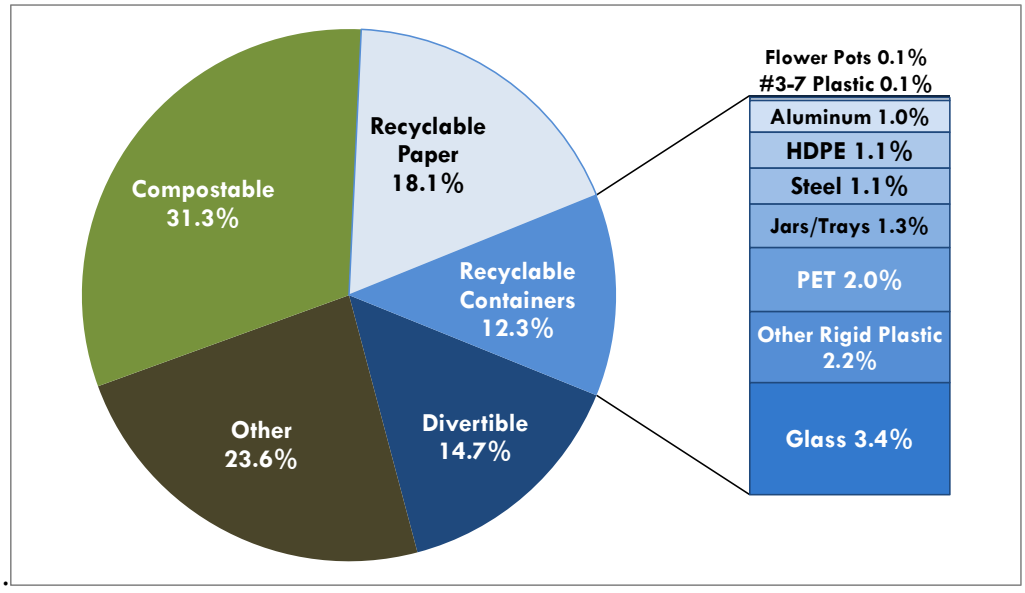


Exhibit 3. Residential Divertible Materials By Weight

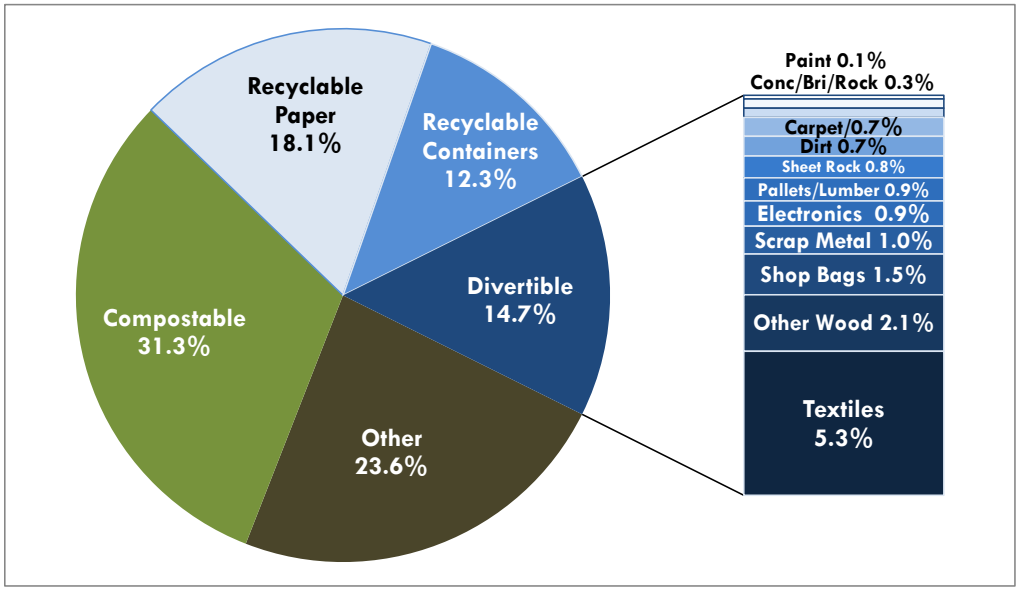


Exhibit 4. Residential Compostable Materials By Weight

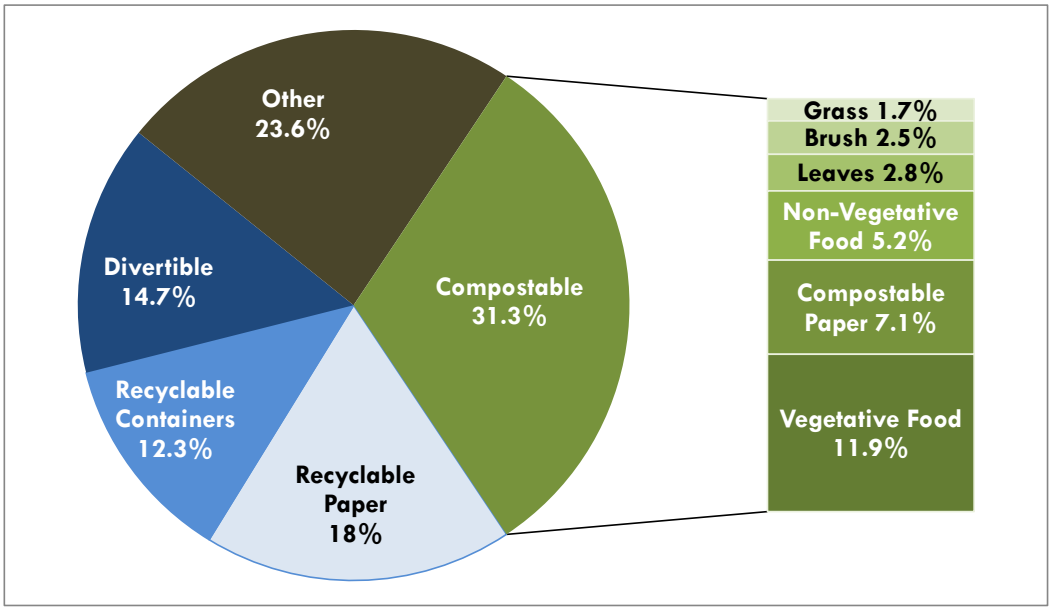
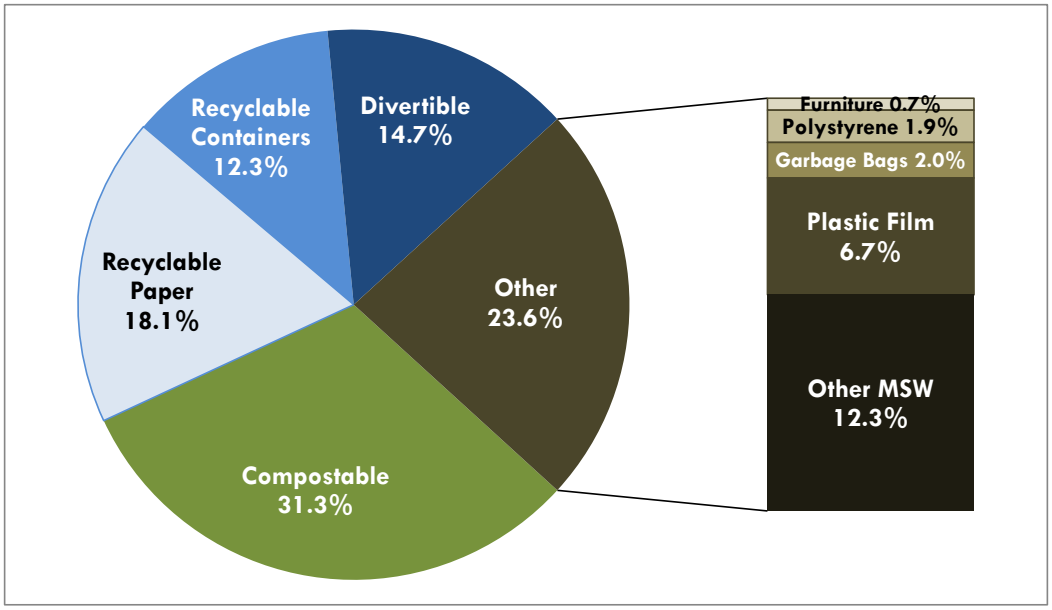


Exhibit 5. Residential Other Materials By Weight



Commercial Waste

Exhibit 6 through **Exhibit 10** present further breakdowns of the major commercial waste categories by weight.

Exhibit 6. Commercial Recyclable Paper By Weight

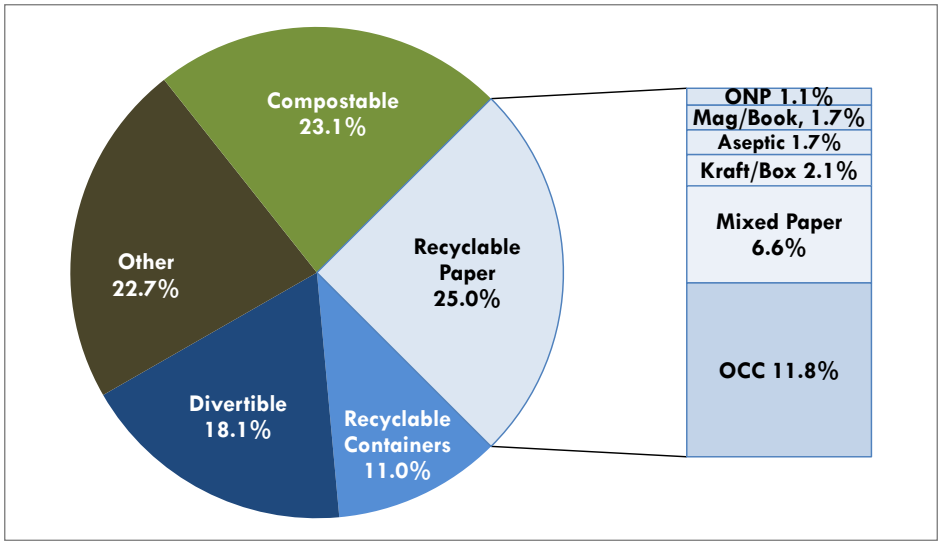


Exhibit 7. Commercial Recyclable Containers By Weight

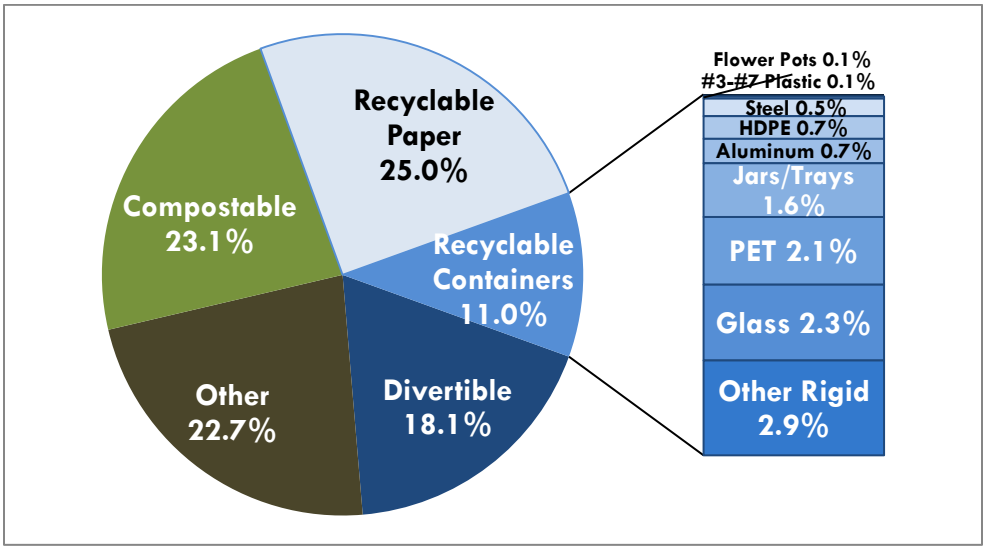


Exhibit 8. Commercial Divertible Materials By Weight

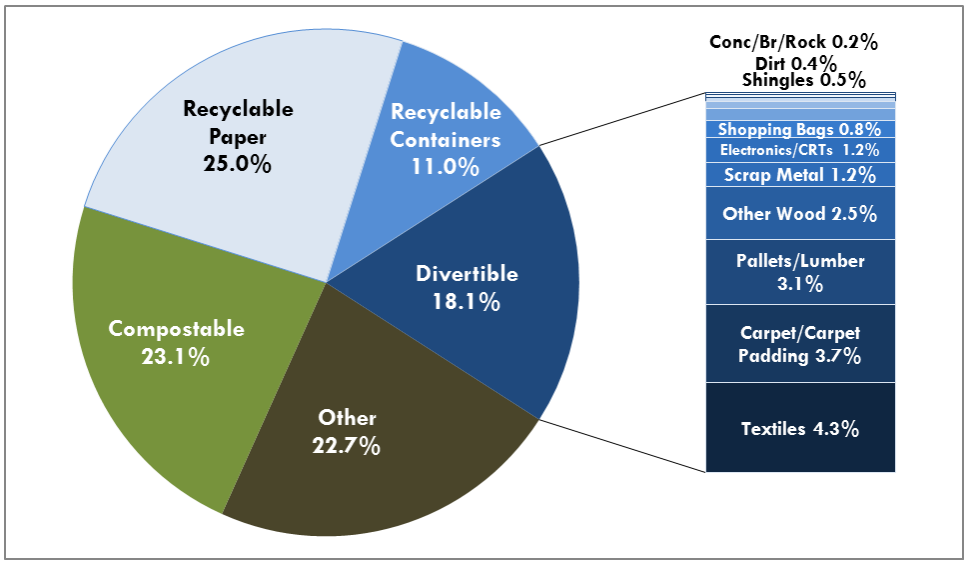


Exhibit 9. Commercial Compostable Materials By Weight

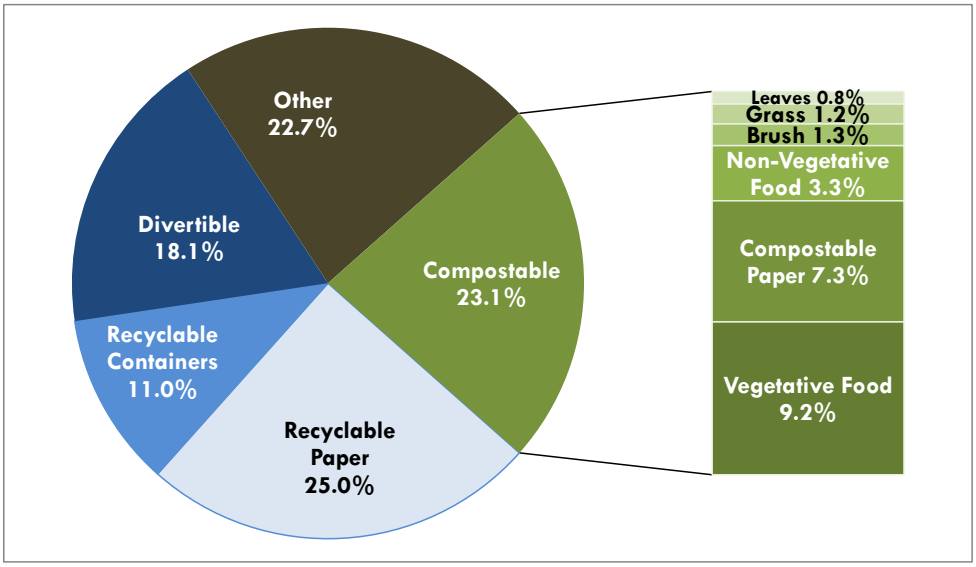
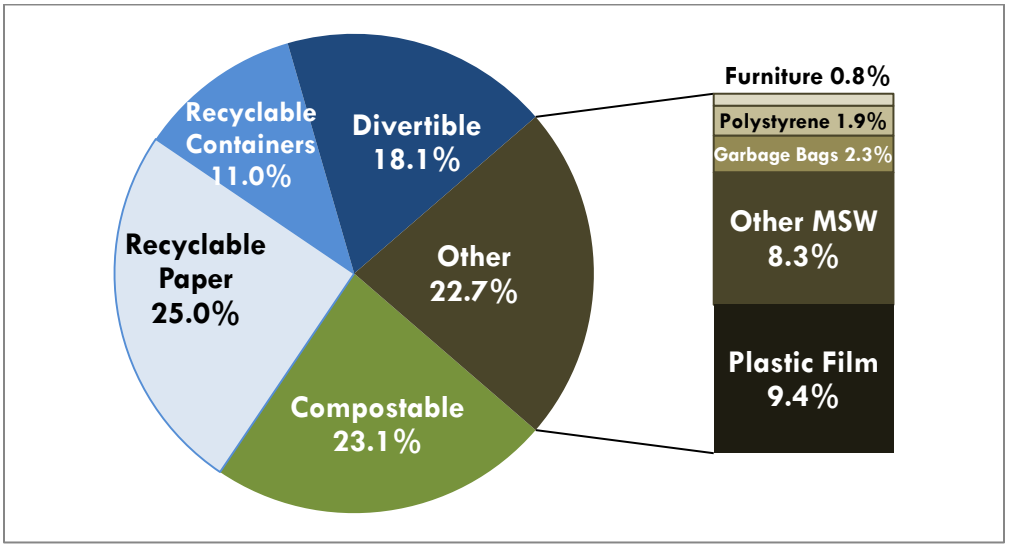


Exhibit 10. Commercial Other Materials By Weight



Public School Waste

Exhibit 11 through **Exhibit 15** present further breakdowns of the major public school waste categories by weight.

Exhibit 11. Public School Recyclable Paper By Weight

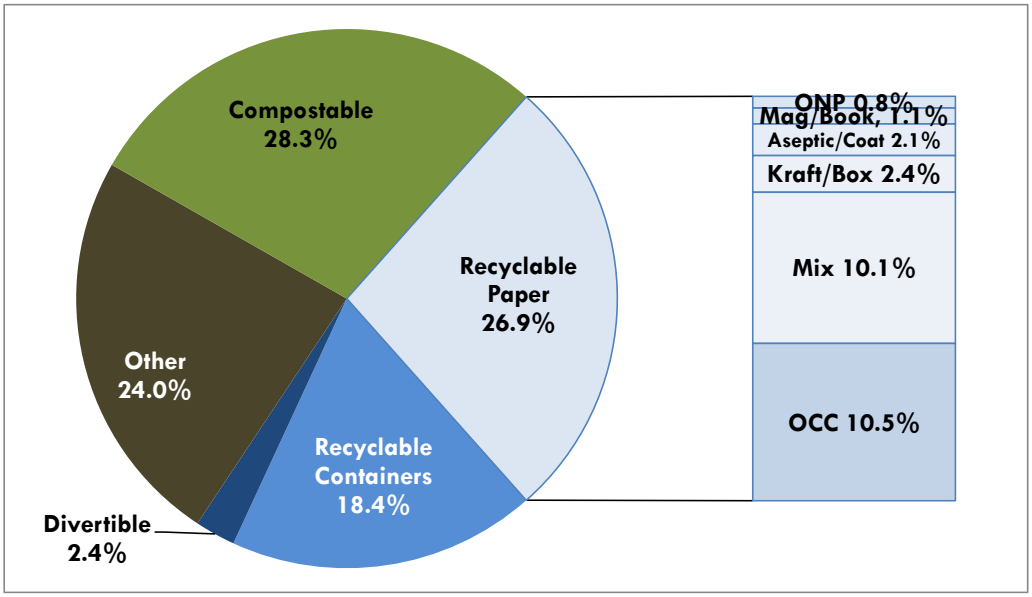


Exhibit 12. Public School Recyclable Containers By Weight

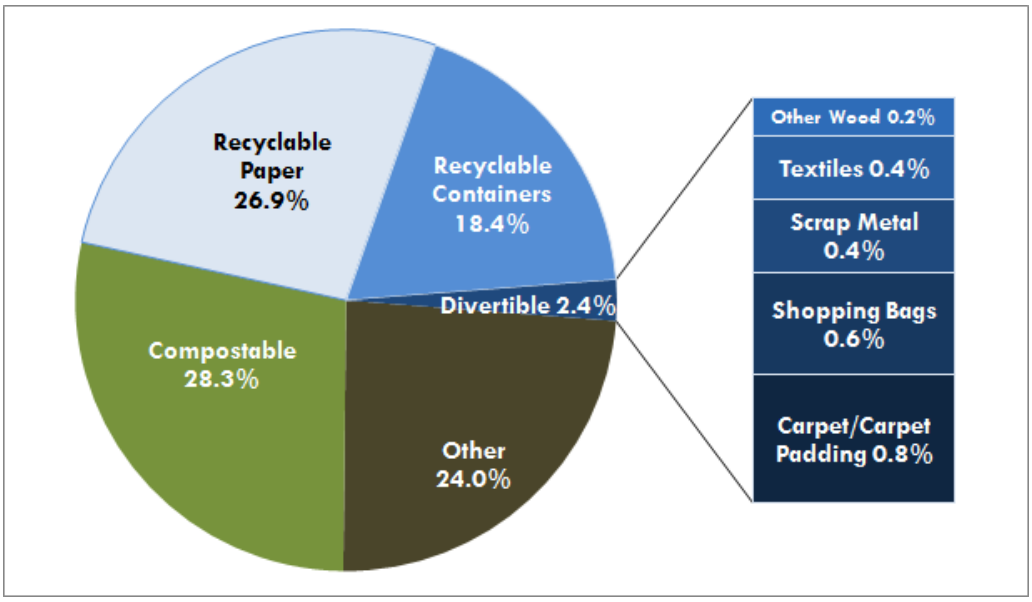


Exhibit 13. Public School Divertible Material By Weight

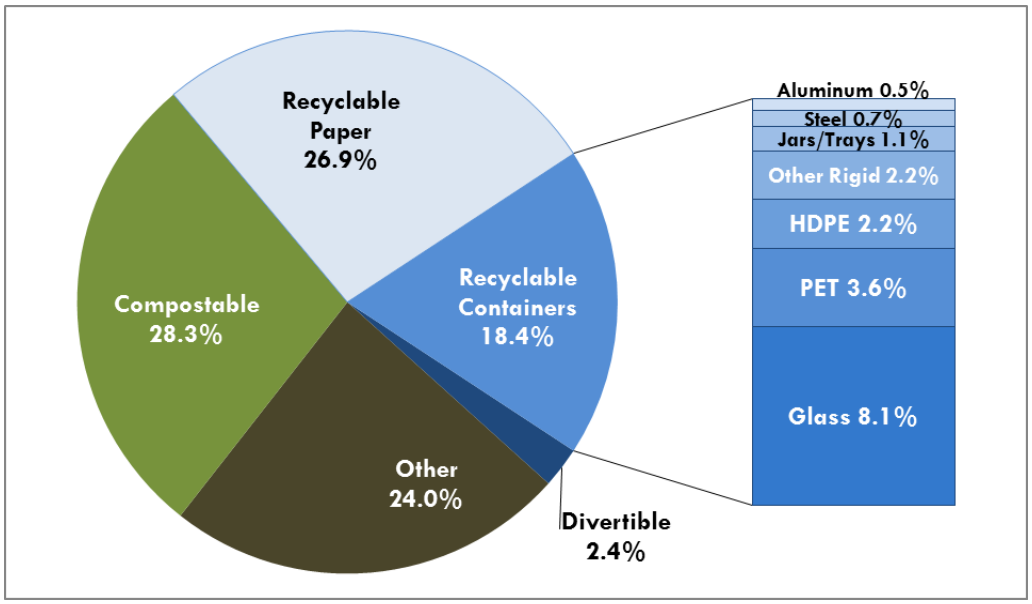


Exhibit 14. Public School Compostable Materials By Weight

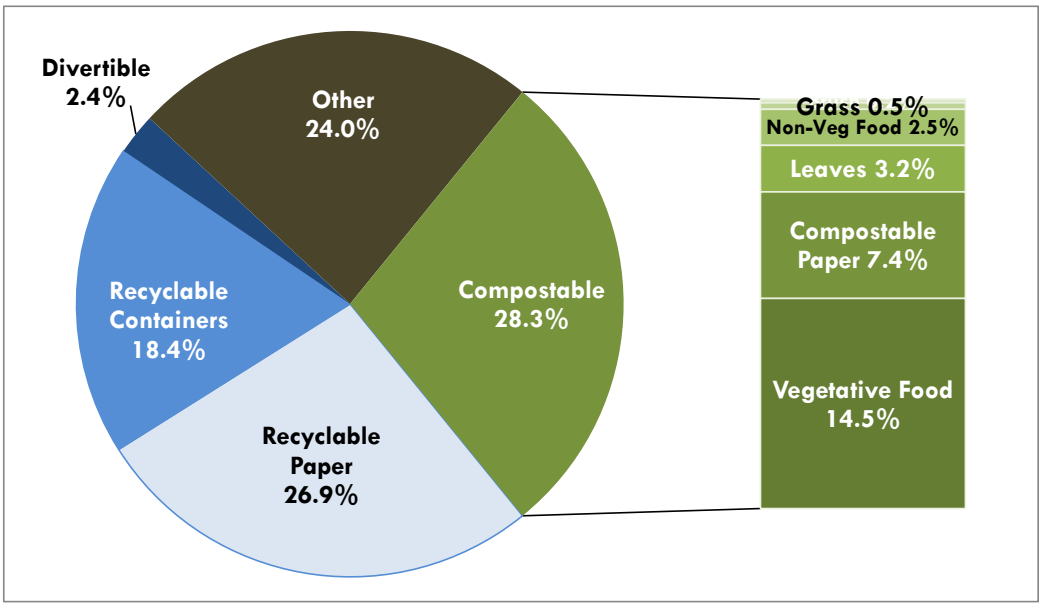
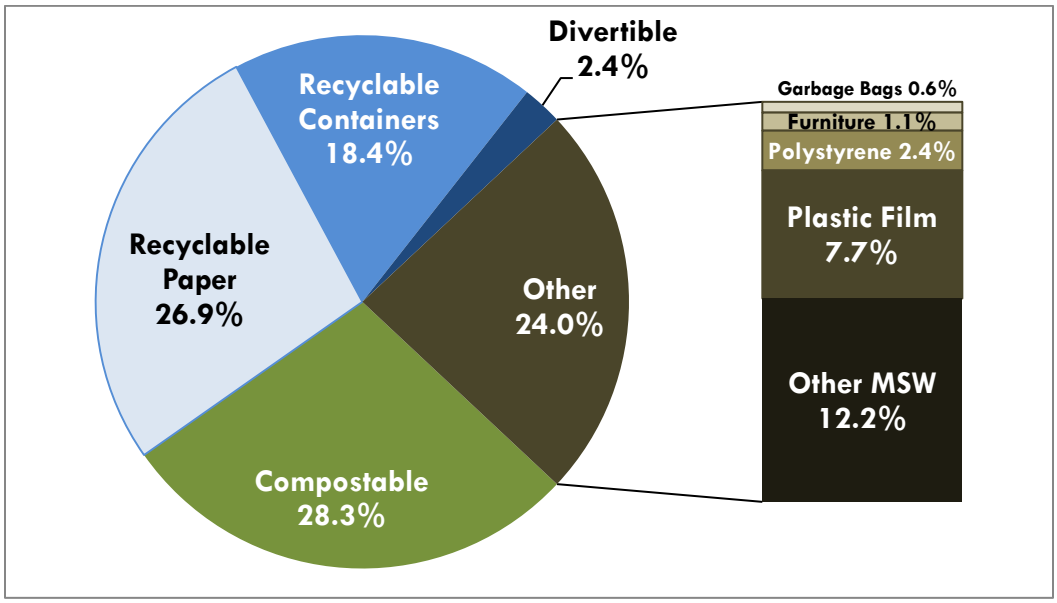


Exhibit 15. Public School Other Materials By Weight



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