Organic Waste Recycling in Montgomery County: Examining Opportunities for Resilient Waste Management

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About the Fellow

Nell Pearson is a Master of City and Regional Planning candidate at the University of Pennsylvania. She is concentrating her studies on environmental planning and land use. Her interests center around urban resilience as well as place-based environmental policy and design solutions. Before Penn, Nell served as an AmeriCorps member at the Gowanus Canal Conservancy, focusing on community outreach, environmental education, and green space advocacy. She graduated from Bates College in 2020 with degrees in history and anthropology.

Acknowledgments

Thank you to Marilu Enciso, Keith Levchenko, DEP staff, and community members for their input and assistance throughout the research process. Additionally, I'd like to express my appreciation for Pam Dunn and Nicole Rodríguez-Hernández and their support throughout the summer.

Key Terms

Aerated Static Pile (ASP): A composting method in which organic waste is placed in large mounds and injected with oxygen via an aeration system.[1]

Aerated Windrow Composting: A composting technique in which organic waste is placed in piles that are four to eight feet tall and fourteen to sixteen feet wide.[2] Organic matter is mixed at specific intervals to infuse oxygen into the piles. This method is suitable for larger-scale composting operations and tends to be relatively cost-effective.

Anaerobic Digestion: The decomposition of organic matter (including wastewater, biosolids, food waste, and manure) using bacteria in an oxygen-free environment, usually a vessel. This process can create biogas and digestate. Biogas, comprised predominately of methane, carbon dioxide, hydrogen sulfide, water vapor, and trace gases, can be a natural gas substitute. Digestate is the remaining matter (both in solid and liquid forms) after the organic waste is decomposed. This can be used as a soil amendment, animal bedding, and as a base for bio-based products.

Compost: A nutrient-rich soil amendment made from decomposed organic materials. Nitrogen-rich "greens" (such as coffee grounds, fruit and vegetable scraps, and grass clippings) are mixed with carbon-rich "brown" materials (such as dried leaves, and wood chips).

Distributive Composting: A dispersed system in which composting is conducted at multiple scales, including backyard, community, on-site, on-farm, and large-scale facilities.

Feedstock: The raw ingredients used to create compost.[3] Composting facilities in Maryland are allowed to process Types 1 and 2.

> **Type 1 Feedstock**: Yard waste, wood materials, and organic materials with a low level of pathogen risk or presence of other hazardous substances.[4]

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[1] "Types of Composting and Understanding the Process," *United States Environmental Protection Agency*, April 21, 2022, https://www.epa.gov/sustainable-management-food/types-composting-and-understanding-process#aeratedstatic.
[2] "Types of Composting and Understanding the Process."
[3] Maryland Department of the Environment, "Guidance for Maryland Composting Facilities," July 2014, https://cc.howardcountymd.gov/LinkClick.aspx?fileticket=eT1gfx6yKlo%3D&portalid=0, 4.
[4] "Code of Maryland Regulations: Sec. 26.04.11.05. Permits Required," April 6, 2021, http://mdrules.elaws.us/comar/26.04.11.05

Type 2 Feedstock: Source-separated pre- and post-consumer organic waste/food scraps, animal manure and bedding, waxed cardboard, compostable products, and industrial food processing materials.

Food Loss: Unused agricultural products, such as unharvested crops.[5]

Food Waste: Edible materials that are wasted at the retail and consumer levels.

Municipal Solid Waste (MSW): Non-hazardous refuse from homes, schools, businesses, and hospitals.[6]

Organic Waste: Food scraps, food waste, and non-recyclable paper as defined by the Montgomery County Department of Environmental Protection.

Yard Trim: Grass clippings, twigs, leaves, branches, and garden debris.

[5] United States Environmental Protection Agency, "Downstream Management of Organic Waste in the United States: Strategies for Methane Mitigation," January 2022, https://www.epa.gov/system/files/documents/2022-01/organic_waste_management_january2022.pdf, 9.

[6] "Criteria for the Definition of Solid Waste and Solid and Hazardous Waste Exclusions," *United States Environmental Protection Agency*, July 31, 2022, https://www.epa.gov/hw/criteria-definition-solid-waste-and-solid-and-hazardous-waste-exclusions

Executive Summary

Montgomery County has made significant strides in reducing waste. The County has the highest recycling and waste diversion rates in Maryland, 58.94% and 63.94% respectively.[7] While Montgomery County utilizes robust recycling infrastructure for inert materials and yard trim, currently there is not a comprehensive system for organic waste[8] collection and processing. Considering the ongoing climate crisis and the County's ambitious climate action objectives, organic waste recycling should be rapidly scaled.[9] The Department of Environmental Protection (DEP) identified several challenges associated with an organic waste diversion in Montgomery County, including few local organic waste processing facilities, added expenditures to convey and process these materials, as well as the need for community buy-in to ensure proper waste separation. Another challenge is the non-standardized residential trash collection system in the County.

To increase organic waste processing capacity, a County-owned composting facility could provide several benefits, such as control of organic waste processing, ensured capacity, revenue from compost sales, and reduced hauling distances. Despite these advantages, proposed compost facilities are often met with opposition. Waste management facilities in the United States have been historically developed in lower income and BIPOC (Black, Indigenous, People of Color) communities, resulting in environmental justice implications. Although composting facilities may yield fewer negative externalities than landfills or incinerators, robust community engagement must be a key part of any site planning and development.

This report investigates the following:

- The current local capacity for organic waste processing

[7] Land and Materials Administration, Maryland Department of the Environment, "Maryland Solid Waste Management and Diversion Report 2021 (CY20 Data)," 2021, https://mde.maryland.gov/programs/land/Documents/MD%20Solid%20Waste%20Management%20and%20Diversion%20Report%20CY20%20%281%29.pdf, 25.

[8] Organic waste in the context of this report refers to food scraps and non-recyclable paper, while yard trim includes dried leaves, twigs, garden debris, and grass clippings.

[9] AECOM, Inspiregreen, "Montgomery County Climate Action Plan: Building a Healthy, Equitable, Resilient Community" (Montgomery County Government, June 2021), https://www.montgomerycountymd.gov/green/Resources/Files/climate/climate-action-plan.pdf

- Evaluation criteria that determine a site suitable for a commercial composting operation
- A GIS site suitability assessment based on the evaluation criteria to determine suitable spaces for an organic waste processing facility

Based on these findings, Montgomery County can catalyze organic waste recycling by exploring the following approaches:

1. Reinforce and bolster distributive compost networks
2. Evaluate the Single-Family Residential Food Scraps Recycling Collection Pilot
3. Analyze alternatives to increase Transfer Station capacity
4. Consolidate the Solid Waste Subdistricts
5. Utilize a community-engaged development process to establish a County composting facility

The County is well positioned to expand its organics recycling capacity while meaningfully incorporating public input and promoting local resilience. Through investment in planning and infrastructure, the County can remain a leader in recycling and advance climate goals.

Introduction

Overview

Solid waste management is an increasing challenge within a linear material economy that "takes, makes, and wastes."[10] Americans disposed of 292 million tons of municipal solid waste (MSW) in 2018, or roughly 4.9 pounds of trash per person every day.[11] Annually, Americans produce 14 million tons of food waste, only 570,000 tons of which are recycled. [12] Food waste makes up approximately 30% of the average household's waste stream.[13] Despite the prevalence of underutilized food resources, 10.5% of American households were food insecure in 2020.[14] This indicates that increased coordination must take place to reduce food waste at its source and redistribute resources to people who can consume them.

While solid waste management presents significant problems logistically, environmentally, economically, and socially, there are opportunities to create circular systems. Composting, a human-mediated process of decomposition, allows for organic waste to be turned into a nutrient-rich soil amendment. Not only does this additive ("compost") improve soil health, but it allows for more water to be retained in soil, reducing runoff and topsoil erosion. When left to rot in a landfill, organic waste produces copious amounts of methane, an extremely potent greenhouse gas (GHG). Although methane only accounted for 11% of US GHG emissions in 2020, it has 28 to 36 times the high heat-trapping potential over one hundred years when compared to carbon dioxide.[15] Landfills are the third

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[10] Juan-Carlos Altamirano, Anne Maassen, and Olivia Prieto, "Moving Beyond 'Take, Make, Waste': Developing Cities Show the Possibilities of the Circular Economy," *World Resources Institute*, October 2, 2017, https://www.wri.org/insights/moving-beyond-take-make-waste-developing-cities-show-possibilities-circular-economy

[11] Adrian Pforzheimer and Alexander Truelove, "Trash in America: Moving from Destructive Consumption towards a Zero-Waste System" (Frontier Group; US PIRG, September 2021), https://environmentamerica.org/sites/environment/files/reports/US_Trash%20in%20America%202021-SCRN.pdf, 4.

[12] "Food Waste Composting," *Maryland Environmental Service*, accessed August 2, 2022, https://menv.com/service/food-waste-composting/

[13] "Composting At Home," *United States Environmental Protection Agency*, July 7, 2022, https://www.epa.gov/recycle/composting-home

[14] Alisha Coleman-Jensen et al., "Food Security in the U.S.: Key Statistics & Graphics," *U.S. Department of Agriculture Economic Research Service*, April 22, 2022, https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-u-s/key-statistics-graphics/#:~:text=Food%2Dinsecure%20households%20include%20those,from%2010.5%20percent%20in%202019

[15] United States Environmental Protection Agency, "Downstream Management of Organic Waste in the United States: Strategies for Methane Mitigation," 1.

largest source of methane emissions, nearly 17% in 2020. Organics have a higher and better use by being transformed into a soil amendment rather than being incinerated or buried.

Organic waste management is a "place-based industry," meaning that it is most efficiently processed at the local or regional level; it is less feasible to export farther distances.[16] The Institute for Local Self-Reliance (ILSR) found that composting supports four times the number of jobs than incinerators or landfills per ton of waste.[17] Throughout the United States, more communities are understanding the benefits of organic waste management, with 326 municipalities offering curbside organics collection.[18]

Regulations and Waste Reduction

The Resource Conservation and Recovery Act (RCRA) of 1976 designates the U.S. Environmental Protection Agency (EPA) as responsible for regulating solid waste management and disposal, with Subtitle D addressing non-hazardous solid waste.[19] The act seeks to protect human and environmental health while also promoting resource protection and conservation. RCRA establishes baseline environmental standards, but States are left to implement programs and issue permits. RCRA Subtitle D establishes "state and local governments as the primary planning, regulating, and implementing entities for the management of nonhazardous solid waste, such as household garbage and nonhazardous industrial solid waste."[20] The EPA provides guidance, regulation, and educational materials to states and local entities so that they can best manage non-hazardous waste at the local level.

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[16] Brenda Platt and Nora Goldstein, "State of Composting in the U.S.," *Biocycle*, July 16, 2014, https://www.biocycle.net/state-of-composting-in-the-u-s/
[17] Platt and Goldstein, "State of Composting in the U.S."
[18] Compost Crew, "The Municipal Guide to Residential Food Scrap Collection," 2020, https://drive.google.com/file/d/1KaM4cwdWY9qn46glDMWF8L4_RmfXwJLH/view
[19] "RCRA's Critical Mission & the Path Forward" (United States Environmental Protection Agency, June 2014), https://www.epa.gov/sites/default/files/2015-09/documents/rcras_critical_mission_and_the_path_forward.pdf
[20] Office of Resources Conservation and Recovery, Program Management, Communications, and Analysis Office, "RCRA Orientation Manual 2014" (Washington, D.C.: United States Environmental Protection Agency, 2014), https://www.anthc.org/wp-content/uploads/2015/12/IEH_RCRA_Orientation_Manual_2014.pdf, I-4.

Section 402 of the Clean Water Act established the National Pollutant Discharge Elimination System (NPDES) which regulates the point source discharge of pollutants into U.S. waters.[21] This applies to pollutant regulation as it pertains to solid waste management.[22] The Clean Air Act regulates stationary pollutant sources related to solid waste management. Additional federal regulations, such as the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Safe Water Drinking Act, FEMA floodplain regulations, and the Public Utilities Regulatory Policies Act (PURA) apply to waste management and are further detailed in Montgomery County's Comprehensive Solid Waste Management Plan.[23] Montgomery County is authorized by the state of Maryland to regulate solid waste management and develop a comprehensive plan for waste facilities, collection, and disposal systems.[24] The Code of Maryland Regulations (COMAR) and the Montgomery County Code set forth additional solid waste management regulations.

Maryland 2021 HB 264: Solid Waste Management - Organics Recycling and Waste Diversion - Food Residuals Maryland requires that large food waste generators separate and compost their organic waste. This will necessitate increased regional capacity to process organic waste. HB 1070: Solid Waste Disposal and Diversion and On-Farm Composting and Compost Use, which has been referred to committee in the Maryland State Assembly, would establish the Stewardship Fund, the Waste Diversion Grant Program, and the On-Farm Composting & Compost Use Grant Program.[25] The Stewardship Fund would provide grants for a variety of stakeholders, including local governments, farms, schools, businesses, nonprofits, and other entities to bolster waste diversion programs and composting infrastructure. Lower income, historically disadvantaged communities, as well as veteran-

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[21] United States Environmental Protection Agency, "Clean Water Act, Section 402: National Pollutant Discharge Elimination System," December 6, 2021, https://www.epa.gov/cwa-404/clean-water-act-section-402-national-pollutant-discharge-elimination-system

[22] United States Environmental Protection Agency, "Clean Water Act (CWA) and Federal Facilities," January 20, 2022, https://www.epa.gov/enforcement/clean-water-act-cwa-and-federal-facilities

[23] See chapter one: Department of Environmental Protection, "Comprehensive 10-Year Solid Waste Management Plan CY 2020 - CY 2029 Montgomery County, Maryland," October 2021, https://www.montgomerycountymd.gov/SWS/Resources/Files/swp/solid-waste-plan.pdf, 1-1 – 1-19.

[24] Department of Environmental Protection, "Comprehensive 10-Year Solid Waste Management Plan CY 2020 - CY 2029 Montgomery County, Maryland," 1-1.

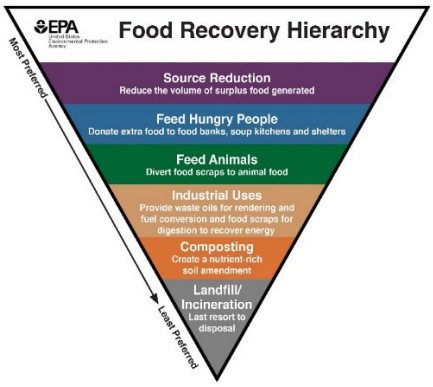
[25] Institute for Local Self-Reliance, "Maryland HB 1070 Solid Waste Disposal and Diversion and On-Farm Composting and Compost Use," accessed August 6, 2022, https://cdn.ilsr.org/wp-content/uploads/2022/02/HB-1070-Fact-Sheet.pdf?_ga=2.101378185.982100188.1659810294-515901107.1656335438&_gl=1*16hz6mc*_ga*NTE1OTAxMTA3LjE2NTYzMzU0Mzg.*_ga_M3134750WM*MTY1OTgxMDI5My4xNy4xLjE2NTk4MTAzNjIuMA..

and women-owned businesses and farmers would be prioritized. Revenue collected from a quarterly solid waste disposal surcharge on owners or operators of state refuse disposal facilities would fund these grants.

At the County level, a recent zoning text change expanded local organic waste processing capacity. Passed in February 2021, the Montgomery County Ag Reserve Zoning Text Amendment allows for farmers to use up to 50% of off-site material to produce compost.[26] The act additionally establishes composting production as an accessory farm activity. This is a helpful step forward in bolstering on-farm composting in the County.

Food Waste Hierarchies

The EPA's Food Recovery Hierarchy highlights preferred methods for waste reduction (figure 1). This approach starts with reducing food waste at its source and progresses to diverting edible food to people and animals, utilizing the waste in industrial processes, composting, and finally landfilling.[27] There are several levels of waste recovery before composting, demonstrating the importance of altered food purchasing, storage, and preparation behaviors as well as networks for food redistribution.



[26] Sophia Jones, "Maryland - Montgomery County Ag Zoning Amendment," *Institute for Local Self-Reliance*, July 9, 2021, https://ilsr.org/rule/on-farm-composting/maryland-montgomery-county/#:~:text=In%20February%202021%2C%20the%20Montgomery,for%20producing%20compost%20or%20mulch.
[27] "Sustainable Materials Management: Non-Hazardous Materials and Waste Management Hierarchy," *United States Environmental Protection Agency*, July 5, 2022, https://www.epa.gov/smm/sustainable-materials-management-non-hazardous-materials-and-waste-management-hierarchy

Figure 1: Food Recovery Hierarchy (the United States Environmental Protection Agency, September 17, 2021)

The Institute for Local Self-Reliance also created a food waste hierarchy for organic materials (see figure 2). ISLR advocates for distributive systems that promote backyard and community composting as primary, on-site institutional, or on-farm composting as secondary, and commercial facilities as tertiary.[28] Communities can adopt a highest and best use philosophy to guide organic waste management planning.

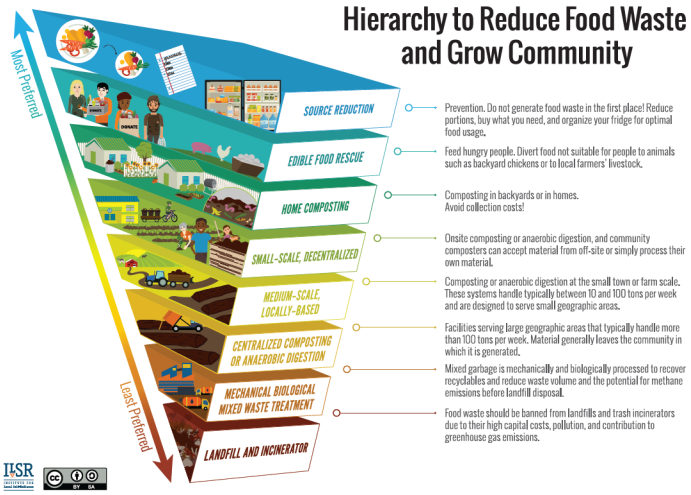


Figure 2: ISLR Hierarchy to Reduce Food Waste (Graphic by Brenda Platt, "Hierarchy to Reduce Food Waste & Grow Community," *Institute for Local Self-Reliance*, April 4, 2017)

Environmental Justice

Climate change does not impact all people equally. This phenomenon, known as the climate gap, posits that lower income communities and people of color are disproportionately impacted by the effects of a changing climate. Environmental justice "embraces the principle that all people and communities are entitled to equal protection of environmental and public health laws and regulations."[29] Waste treatment facilities in the United States have historically been placed adjacent to or in BIPOC and socioeconomically disadvantaged communities, with significant public health

[28] Platt and Goldstein, "State of Composting in the U.S."
[29] Robert D. Bullard, "Environmental Justice: It's More Than Waste Facility Siting," *Social Science Quarterly* 77, no. 3 (September 1996), 493.

implications. When considering a composting facility in Montgomery County, an equity-based approach should guide the siting process, in which legacies of environmental racism are acknowledged and redressed. While composting is less environmentally disruptive than a landfill or incinerator, it will still require waste hauling and may have perceived negative externalities (such as odors or vermin). Ensuring that the community is aware of the benefits of organic waste management and actively engaged with the siting process can help to improve buy-in and mitigate negative outcomes.

Paper Overview

Montgomery County is uniquely positioned to build upon existing efforts to expand organic waste recycling to reach more residents, and eventually the entire county. Local leaders, government officials, residents, environmental advocates, farmers, and other relevant stakeholders must collaborate to forge context-specific solutions. This paper examines the County's existing waste infrastructure, regional organic waste processing capacity, best practices for compost facility siting, and a site suitability analysis. Based on this information, five recommendations are provided to strengthen organic waste recycling. As organics diversion continues to scale in the County, the community must be actively involved and meaningfully included in the planning, design, and operation of this waste management system.

Current Conditions

In 2020, 98,505 tons of food waste were disposed of in Montgomery County. Almost half of the County's organics were created by single-family homes and over 40% were created by commercial businesses, organizations, and institutions (see figure 3).[30]

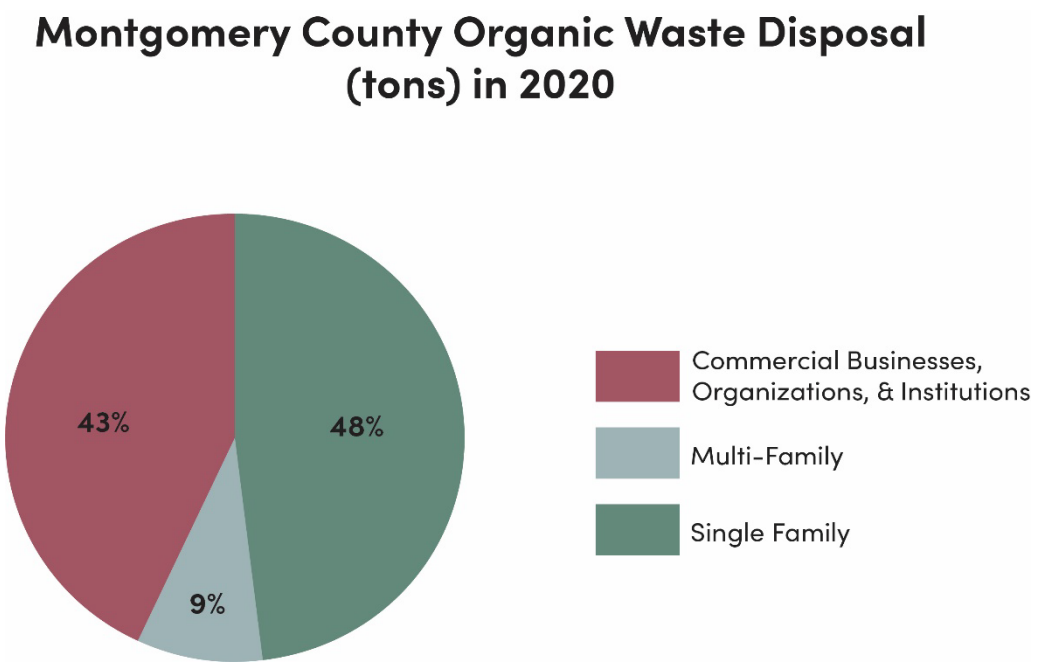


Figure 3: Montgomery County Organic Waste Disposal (Chart by author, Source: Montgomery County Capture Model CY 2020)

The County has adopted an organic waste hierarchy, similar to the EPA's Food Recovery Hierarchy (figure 1), that first focuses on waste reduction, then reuse, recycling, composting, waste to energy, and landfilling. The 2018 Food Waste Strategic Plan presents the following approach to organic waste management:

- Reducing wasted food/channeling food to others
- In-Home, Backyard, and Community-Scale Composting
- On-Site Institutional and On-Site Business Composting
- On-Farm Composting

- Composting Capacity to Serve Montgomery County
- Strategies to Maximize Food Scraps Collection at the Curb[31]

The County's 2016-2017 Waste Characterization Study revealed that 31.2% of the overall waste stream was compostable (including organics, yard waste, and paper).[32] Food waste had a 2% decrease from 2012-13 to 2016-17 from 22.8% to 20%.[33]

Montgomery County's Waste Management System

Montgomery County collects residential solid waste from residences that are six units and under, while municipalities within the County are responsible for providing their residential collection services. Multi-family buildings (seven or more units), businesses, and institutions must contract services, or they can haul their waste to processing facilities.[34] The County is divided into two solid waste collection districts (see figure 4). In Subdistrict A, the County contracts private haulers to collect refuse, recycling, and yard trimmings. Curbside pick-up is offered one time per week and five bulky waste pick-ups are provided annually. In Subdistrict B, customers procure refuse hauling services directly from contractors. The County provides yard waste and recycling collection in both districts, serving 217,000 single-family households.

Waste is collected at the Shady Grove Waste Transfer Station where it is separated for processing. Most nonrecyclable MSW is sent to the Montgomery County Resource Recovery Facility (MCRRF) and its ash is transported to a landfill in Virginia. MCRRF began operation in 1995 and has a

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[31] Department of Environmental Protection Division of Solid Waste Services, "Strategic Plan to Advance Composting, Compost Use, and Food Scraps Diversion in Montgomery County, Maryland" (Montgomery County Government, April 2018), https://www.montgomerycountymd.gov/SWS/Resources/Files/foodwaste/Strategic%20Plan%20to%20Advance%20Composting%2C%20Compost%20Use%2C%20and%20Food%20Scraps%20Diversion%20in%20Montgomery%20County%2C%20MD.pdf

[32] Annette Scotto, Andrea Ramirez, and Christine Roarke, "Aiming for Zero Waste Montgomery County Maryland: Baseline Review and Current State Assessment" (HDR, December 2018), https://www.montgomerycountymd.gov/SWS/Resources/Files/master-plan/current-assessment.pdf, 5.

[33] Scotto, Ramirez, and Roarke, "Aiming for Zero Waste Montgomery County Maryland: Baseline Review and Current State Assessment,"

[34] Department of Environmental Protection Division of Solid Waste Services, "Strategic Plan to Advance Composting, Compost Use, and Food Scraps Diversion in Montgomery County, Maryland," 10.

processing cap of 657,000 tons of waste per year. Other non-recyclable waste is sent to a landfill in Pennsylvania.

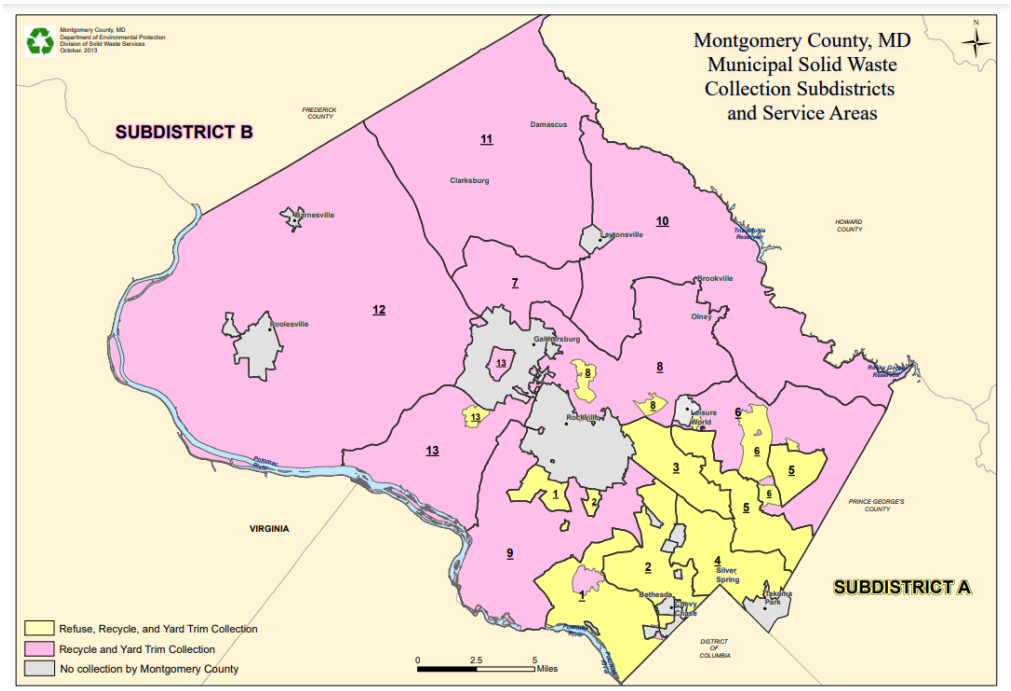

Figure 4: MSW Collection Subdistricts in Montgomery County (Map by Department of Environmental Protection, Division of Solid Waste Services, *Montgomery County, MD Municipal Solid Waste Collection Subdistricts and Service Areas*, October 2013)

Current Organic Recycling Initiatives

Montgomery County is currently pursuing organic and yard waste recycling at various scales. Existing infrastructure includes the Montgomery County Yard Trim Composting Facility at Dickerson. Smaller-scale pilots are in place to promote backyard composting and to support commercial entities with organics separation and hauling. A pilot curbside organics recycling program was initiated in late 2021 with the possibility to expand county-wide soon as results and budget become available. These initiatives and existing infrastructure assets represent a strong foundation by which the County can continue to scale its organic recycling efforts.

The Montgomery County Yard Trim Composting Facility

The Montgomery County Yard Trim Composting Facility processes approximately 60,000 tons of yard waste per year, with a permit cap of 77,000 tons. 217,000 residences that receive county

recycling services are also required to source separate their yard waste, including leaves, vegetation, grass clippings, brush, and sticks. [35] The Yard Trim Composting Facility is funded through the solid waste fund on property taxes. Most materials are taken to the Silver Spring Depot and the County Transfer Station where they are processed by a horizontal grinder to reduce volume. The yard trim is then conveyed to the Dickerson Facility by truck or rail. Brush is separated and chipped into mulch which is then sold. The Facility processes yard trim via windrows on a 50-acre asphalt pad. The facility has an operating budget of $4 million and generates $1.5 to $2 million in revenue per year by selling finished compost.

The Sugarloaf Citizens Association (SCA) sued Montgomery County over an alteration to the compost facility that violated a 1981 stipulation agreement. The two parties entered a negotiated settlement that limits the organic waste processing capacity at the Dickerson Yard Trim Facility to 77,000 tons per year.[36] To make any alterations to current processing regulations, SCA must review and approve the changes. Recent conversations have included expanding the site's capacity to handle food waste if the County closes the MCRRF. While such a compromise would allow for roughly 40,000 tons of food scrap recycling at the Dickerson Facility per year, this would require a rapid closure of the MCRRF, which can process up to 657,000 tons of MSW per year. A solution to manage the remaining tons of mixed MSW, such as sending it to a landfill, would have to be determined. As the future of this potential arrangement is still uncertain, other food waste recycling opportunities must be explored.

Backyard Composting

In FY 2022, DEP began a pilot study to ascertain which backyard compost bins (static or tumbler models) are most successful. Chapter 48 of the Montgomery County Code specifies that backyard food scrap composting must be done in rodent-proof bins. A group of 900 residents volunteered to test the two types of bins in the fall and spring. Participants were provided with

[35] Department of Environmental Protection Division of Solid Waste Services, "Strategic Plan to Advance Composting, Compost Use, and Food Scraps Diversion in Montgomery County, Maryland," 9.
[36] Harris, Smariga and Associates, INC., "Facilities Master Plan for the Solid Waste Operations in the Dickerson Area," August 2013, https://www.montgomerycountymd.gov/SWS/Resources/Files/dafig/dickerson-facilities-master-plan.pdf, 2-10.

training, educational materials, a data sheet, and necessary tools like a scale and thermometer. DEP offered six training sessions, four held in English and two in Chinese. Participants tracked the weight of their food waste each month on a data sheet. As many stakeholders have expressed concerns about improper use of backyard composting systems, DEP is attempting to make recommendations based on this study and advocate for backyard composting. While the future of this initiative is still in development, there is hope that the rodent-proof compost bin models could be offered at a discounted rate to residents.

Commercial Food Scraps Recycling Partnership

The Commercial Food Scraps Recycling Partnership Program began in April 2020. After discussions with waste haulers and commercial businesses, Montgomery County DEP ascertained that there were many barriers for businesses to separate organic waste and contract haulers. This program seeks to increase commercial composting rates by providing customized education and waste management solutions for businesses. DEP works with businesses over 12 to 18 months to tailor a food waste diversion system for their unique context. DEP collects food scraps and transports them to the Prince George's County Composting Facility at no cost to the businesses. The Department additionally tracks data stop-by-stop and shares this information with participating businesses so they can ascertain their organic waste production levels. At 6 - and 12-month check-ins, DEP provides feedback and speaks with the businesses about their experiences. At the end of the program, businesses are left with an organic waste separation system and data to create a reasonable contract with waste haulers.

Single-Family Residential Food Scraps Recycling Collection Pilot

Curbside organics collection can help to make organic waste disposal more accessible. Many communities elect to begin curbside organics diversion with single-family homes. Multifamily residences tend to have greater challenges when diverting organic waste due to physical constraints of buildings, high turnover of residents (necessitating sustained educational outreach), and the need

for the property manager or owner's buy-in.[37] While more cities and counties are initiating curbside organics collection programs, there have been significant challenges ensuring feasibility and system compliance. Organic waste tends to be extremely heavy because of its high water content, resulting in increased hauling expenditures. Many residents who have access to curbside organic waste collection services may be uncertain of how to properly sort their waste. Establishing a curbside collection system is a significant upfront expense, in some cases accounting for 50 to 75% of total processing costs for organic waste management systems.[38]

Montgomery County began the single-family residential food scraps recycling collection pilot in November/December 2021, collecting food scraps on two routes in Potomac and Silver Spring. 17% of eligible households in Potomac and 30% of households in Silver Spring registered for the service. Roughly 10 pounds of food waste per household is diverted each week. The pilot will continue through August 2023 and hopefully will be expanded soon. Currently, the County contracts with the Compost Crew to haul food scraps to the Prince George's County composting facility. Community outreach surrounding the pilot included an announcement letter, door hangers, informational sessions at HOA meetings, and tabling at local events. The success of this model will help DEP to understand if curbside collection may be feasible at a larger scale throughout the County.

[37] United States Environmental Protection Agency, "Downstream Management of Organic Waste in the United States: Strategies for Methane Mitigation."
[38] United States Environmental Protection Agency, "Downstream Management of Organic Waste in the United States: Strategies for Methane Mitigation," 30.

Inventory of Regional Organic Waste Processing Facilities

In the US, an estimated 70% of composting operations process yard waste exclusively.[39] To rapidly scale, using existing yard trim facilities to compost organic waste could be a good opportunity. But this remains challenging as those facilities may not have the proper permits, equipment, or trained personnel to process food scraps.

Because there is only a yard trim composting facility operated in Montgomery County, it is critical to understand what other organic processing facilities operate in the greater region. Table 1 lists regional facilities and their distance to the Shady Grove Processing Facility and Transfer Station in Derwood, MD. DEP identified that procuring services from facilities within a 30-mile radius of the Transfer Station would be the most cost-effective for waste hauling. While the county currently contracts Compost Crew, a local company, to haul organic waste from the curbside collection pilot program to Prince George's County, having a county-owned facility provides increased stability and self-reliance.

There remains a relatively low number of permitted facilities that can process organic via composting or anaerobic digestion. An inventory of regional facilities (see figure 5) reveals that the Devco Biodigester in Jessup, MD is the only facility within a 30-mile radius of the County's transfer station capable of processing the County's food waste. A larger-scale composting facility in Montgomery County would help to capture residential as well as commercially generated waste (an estimated 79,000 tons per year).[40] The County has faced a "lack of long-term, stable food scrap composting processing facilities to serve the region."[41] DEP has stated that "explor[ing] feasibility of using in-County capacity, including County-owned property(ies) for processing source-separated food scraps and other acceptable organic materials" is a main objective.[42]

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[39] Platt and Goldstein, "State of Composting in the U.S."
[40] Department of Environmental Protection Division of Solid Waste Services, "Strategic Plan to Advance Composting, Compost Use, and Food Scraps Diversion in Montgomery County, Maryland."
[41] Department of Environmental Protection Division of Solid Waste Services, "Strategic Plan to Advance Composting, Compost Use, and Food Scraps Diversion in Montgomery County, Maryland," 7.
[42] Department of Environmental Protection Division of Solid Waste Services, "Strategic Plan to Advance Composting, Compost Use, and Food Scraps Diversion in Montgomery County, Maryland," 8.

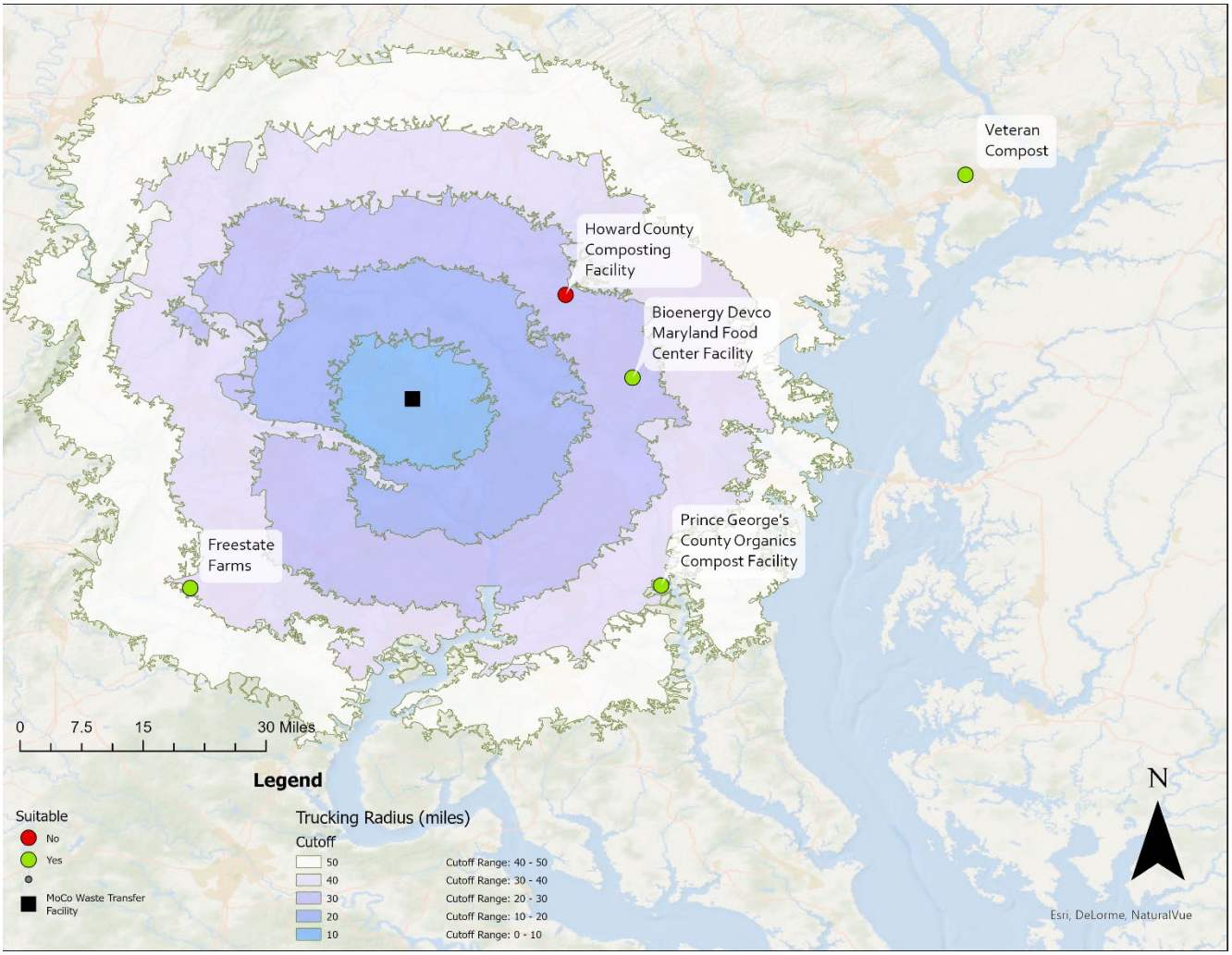

Figure 5: Existing Organic Waste Processing Facilities within a 50-mile Trucking Radius of Montgomery County's Transfer Station. (Map by author.)

Name	Location	Distance (miles)	Technology	Tipping Fees ($/ton)	Acceptable Materials	Annual Capacity (tons/year)	Accepts Materials from MoCo?
Alpha Ridge Landfill – Howard County	Marriottsville, MD	27.4	Aerated Static Pile	n/a	Yard trimmings, food scraps	12,000	No
Bioenergy Devco Maryland Food Center Facility	Annapolis, MD	29	Anaerobic digester	10% - 20% lower than MSW tipping fees on average	Food scraps, wastewater sludge	110,000	Yes
Freestate Farms	Manassas, VA	43.3	Aerated Static Pile	$35-40	Food and yard waste	80,000	Yes
Veteran Compost	Aberdeen, MD	72.6	Extended Aerated Static Pile	Customers must call for daily tip fees	Pre-consumer food scraps	24,000	Yes
Prince George's County Organics Compost Facility	Upper Marlboro, MD	43.8	GORE Cover System (food scraps); Windrows (yard trim)	Customers must obtain tip fees	Food scraps and yard waste	69,000	Yes

Table 1: Regional Food Scrap Recycling Facilities (Table by author, Sources: Maryland Department of the Environment, "Composting Facilities - Permitting & Operational Status," July 2021; Interviews with facility operators.)

Best Practices for Compost Facility Siting

Local, state, and federal regulations dictate where a large-scale composting facility can be located. Local zoning in Montgomery County indicates that perhaps an agricultural or industrial area would be most suitable. A county-owned composting facility would be designated for a public use and therefore it would technically be permitted in every zone. The facility, however, would be subject to development standards of a given zone for any structure built.

Despite the relative flexibility in siting as permitted by zoning, it would be best to locate a facility in an area farther away from residential development. Many waste management practitioners agree that selecting an area with "very low surrounding population density will have the lowest health and environmental impact."[43] But in some contexts where there are only parcels close to existing development, it is possible to utilize compact composting technologies in repurposed spaces. Options like the Gore Cover System or anaerobic digestion can be effectively operated on smaller sites while still mitigating odor, vermin, and noise. Odors surrounding compost sites are a result of anaerobic conditions, smelly organic waste, or ammonia being emitted from nitrogen-rich materials. Rapid processing of materials and adequate aeration of compost piles can help to reduce nuisances.[44]

The EPA posits that "exclusionary, technical, and community-specific criteria" should be applied throughout the facility siting process.[45] Exclusionary criteria refer to standards such as local, state, or federal regulations as well as environmental protection guidelines. Technical criteria include requirements, such as proximity to existing transportation routes and networks, parcel size, space for truck movement and queuing, and on-site utilities. Community-specific criteria entail environmental justice concerns, air pollution, traffic, and proximity to existing development. North Carolina State Extension asserts that additional qualifications for site selection might include predicted organic

[43] Zero Waste Montgomery County, "Beyond Incineration: Best Waste Management Strategies for Montgomery County, Maryland," 2021, http://www.energyjustice.net/md/beyond.pdf, 78.
[44] Rhonda Sherman, "Large-Scale Organic Materials Composting," *NC State Extension*, January 16, 2022, https://content.ces.ncsu.edu/large-scale-organic-materials-composting
[45] Solid Waste and Emergency Response, United States Environmental Protection Agency, "Waste Transfer Stations: A Manual for Decision-Making," June 2002, https://www.epa.gov/sites/default/files/2016-03/documents/r02002.pdf, 14.

waste demand, the type of composting system, site operation and management requirements, as well as future demand for organic waste processing.[46]

Maryland Department of the Environment (MDE) issues general composting facility permits and regulates site operations, processing capacities, and materials (feedstock types 1 and 2 are permitted). Sites cannot create a nuisance, attract insects or rodents, produce nuisance odors or air pollution, discharge pollutants into waterways, harm the environment, or create hazards to public health, safety, or comfort.[47] The state requires several siting guidelines that are enforced except where a greater setback is required by local, State, or federal law:

(a) 50 feet to the property line of a property not owned or controlled by the operator of the composting facility;

(b) 300 feet to a dwelling not owned or operated by the operator of the composting facility;

(c) 100 feet to a domestic well; and

(d) 100 feet to a stream, lake, or other body of water except for an impoundment for use in the composting process.[48]

Additionally, the site must not be within a floodplain (unless approved by the Department), or the Chesapeake Bay Critical Area Commission Criteria. The facility must be constructed per development standards related to nontidal and tidal wetlands, manage stormwater discharges by obtaining an NPDES permit, and meet state and local erosion and sediment control requirements.

Community Engagement

The EPA states that the problem of siting a waste facility "is not simply a technical one – it is social, economic, and political."[49] Acknowledging these multifaceted dynamics requires meaningful

[46] Sherman, "Large-Scale Organic Materials Composting."
[47] "Code of Maryland Regulations: Sec. 26.04.11.04. General Restrictions and Specifically Prohibited Acts," April 6, 2021, http://mdrules.elaws.us/comar/26.04.11.04
[48] "Code of Maryland Regulations: Composting Facility Siting and Design Requirements," April 6, 2021, http://mdrules.elaws.us/comar/26.04.11.08

[49] Office of Solid Waste, Office of Policy, Planning, and Evaluation, U.S. Environmental Protection Agency, "Sites for Our Solid Waste: A Guidebook for Effective Public Involvement," 1990, https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=10001ABQ.txt, 5.

engagement with community members to determine context-specific siting solutions. Public participation is defined as "any process that directly engages the public in decision-making and gives full consideration to public input in making that decision."[50] Engagement is conducted over a series of interactions that continue for the "full lifespan of a project to both inform the public and obtain input from them."[51] Outreach plans may utilize an array of methods to allow for degrees of shared decision authority (see table 2), ranging from solely informing the public to meaningfully incorporating public input.[52] Successful engagement will have the following elements: a clear purpose and goal, clear structure and process, actual opportunity for influence, commitment to the process, and inclusive and effective representation.[53]

Level of Participation	Goals	Examples
Inform	To keep the public aware of current issues as well as alternatives and solutions	Newspaper articles, social media posts, mailers, website
Consult	To receive the public's opinions on alternatives and decisions	Interactive websites, public meetings, focus groups
Involve	To guarantee that the public's opinions are collected throughout the decision-making process, especially when developing criteria and alternatives	Public workshops, national issues forums
Collaborate	To work with the public to create decision criteria and alternatives and to identify solutions	Citizen advisory committees, citizens jury
Empower	To allow the public to make decisions	Delegated decision-making, Participatory budgeting

Table 2: Modified Spectrum of Participation (Table by author, Adapted Modified Spectrum of Participation from Tina Nabatchi, "A Manager's Guide to Evaluating Citizen Participation," Fostering Transparency and Democracy Series, IBM Center for the Business of Government, 2012, 11, fig. 1).

[50] "Public Participation Guide: Introduction to Public Participation," *United States Environmental Protection Agency*, February 17, 2022, https://www.epa.gov/international-cooperation/public-participation-guide-introduction-public-participation
[51] "Public Participation Guide: Introduction to Public Participation."
[52] "Public Participation Guide: Introduction to Public Participation."
[53] "Public Participation Guide: Introduction to Public Participation."

Government officials have historically utilized the "Decide, Announce, Defend model" in which select experts determine site suitability. This approach fosters distrust, especially since the American public is wary of technical information and inequitable historic land use decisions.[54] Successful siting efforts "require both political and technical expertise by public officials and citizens."[55] The Three Phase Siting Framework for waste processing facilities provides guidance to plan and select a site as well as create long-term facility operation strategies (see figure 6). A diverse group of stakeholders should be involved throughout the three phases. The EPA recommends utilizing risk communication to inform the public of potential challenges, mitigation strategies to account for public opinions, and evaluation methods to obtain and synthesize feedback throughout the siting process (focus groups, surveys, etc.).[56]

Phase I: Planning	
-Identifying the Problem	Recognizing the growing waste stream, rising costs and capacity shortfall.
-Designing the Siting Strategy	Planning and integrating public involvement, risk communication, mitigation, and evaluation activities.
-Assessing Alternatives	Researching, debating, and choosing among the options: recycling, source reduction, incineration, and land disposal.
-Choosing Site Feasibility Criteria	Studying population densitites, hydrological conditions, and socioeconomic characteristics.

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Phase II: Site Selection and Facility Design	
-Selecting the Site	Performing initial site screening and designation; conducting permit procedures; developing environmental impact statement.
-Designing the Facility	Choosing technologies, dimensions, safety characteristics, restrictions, mitigation plans, compensation arrangements, and construction.

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Phase III: Implementation	
-Operation	Monitoring incoming waste; managing waste disposal; performing visual and lab testing; controlling noise, litter, and odor.
-Management	Monitoring operations and safety features; performing random testing of waste; enforcing permit conditions.
-Closure and Future Uses	Closing and securing the facility; deciding on future land uses; and performing continued monitoring.

[54] Office of Solid Waste, Office of Policy, Planning, and Evaluation, U.S. Environmental Protection Agency, "Sites for Our Solid Waste: A Guidebook for Effective Public Involvement," 9.
[55] Office of Solid Waste, Office of Policy, Planning, and Evaluation, U.S. Environmental Protection Agency, "Sites for Our Solid Waste: A Guidebook for Effective Public Involvement," 20.
[56] Office of Solid Waste, Office of Policy, Planning, and Evaluation, U.S. Environmental Protection Agency, "Sites for Our Solid Waste: A Guidebook for Effective Public Involvement," 8.

Figure 6: The Three Phase Siting Framework for Waste Processing Facilities (Figure by author, Adapted from Office of Solid Waste, Office of Policy, Planning, and Evaluation, U.S. Environmental Protection Agency, "Sites for Our Solid Waste: A Guidebook for Effective Public Involvement," 11, fig. 2-1).

The public represents a range of stakeholders with varying levels of involvement (see figure 7). Multiple participation channels are needed to meet different levels of engagement. Officials have an overall obligation to the public to inform them of proposed actions, including their benefits and consequences, as well as solicit feedback from all segments of the community. Best practices include developing a public involvement plan that harnesses the local knowledge and social capital of existing advocacy networks.

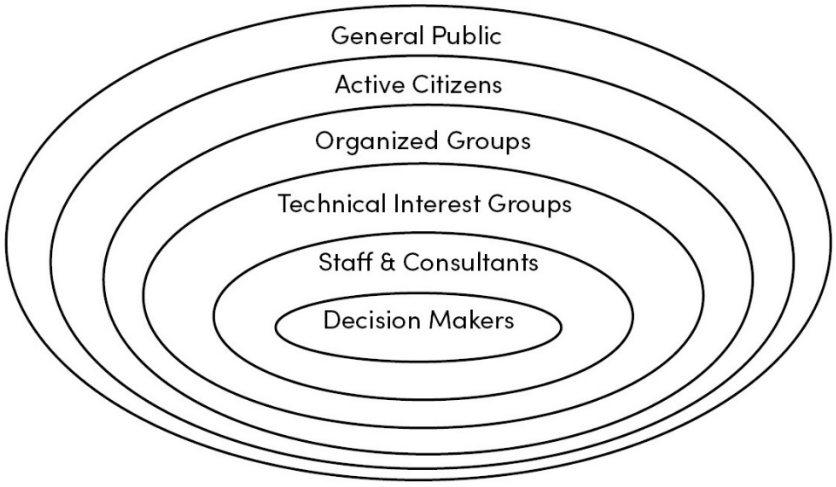

Figure 7: Levels of Involvement by Various Segments of the Public (Figure by author, Adapted from Office of Solid Waste, Office of Policy, Planning, and Evaluation, U.S. Environmental Protection Agency, "Sites for Our Solid Waste: A Guidebook for Effective Public Involvement," 26, fig. 4-1).

Montgomery County has developed Equity Emphasis areas to identify areas where social and racial equity might be especially concentrated. Montgomery Planning determined that roughly 26% of the County's population lives in Equity Focus Areas, equivalent to 275,875 people.[57] The equity analysis incorporates "household income, race and ethnicity, and the ability to speak English– to identify areas of the county that may experience the highest inequities in access to transportation,

[57] "The Equity Focus Areas Analysis," Montgomery Planning, Montgomery County MD, July 13, 2022, https://montgomeryplanning.org/planning/equity-agenda-for-planning/the-equity-focus-areas-analysis/

job opportunities, and other resources supporting a high quality of life."[58] Equity areas should be considered within the site selection process. Additionally, the impact of the larger organic recycling system should be considered in relation to these spaces, for example, if trucking routes are disproportionately bisecting BIPOC communities.

Public engagement allows for governments to make decisions that more accurately reflect the interests of the public and build community capacity. Deploying a thoughtful and inclusive public engagement strategy will help to strengthen the County's overall organic waste management system.

[58] "The Equity Focus Areas Analysis."

Compost Facility Site Suitability Analysis

The County currently sends organic waste from residential and commercial pilot programs to the Prince George's County composting facility. While this solution is functional in the short term, the Prince George's facility is mandated to serve its constituents before accommodating other clients and is over 30 miles away from Montgomery County's Waste Transfer station. Given this situation, expanding in-County organic waste processing capacity would be ideal to promote resilience and reduce waste hauling distances. Some County studies mentioned the feasibility of utilizing the Yard Trim Composting Facility at Dickerson or Site Two [59] for organic waste composting. Unfortunately, both sites have significant limitations. [60] Utilizing GIS (Geographic Information Systems), I examined parcels within Montgomery County to determine if they would meet various technical requirements for a composting facility.

The following parameters were considered:

- **Exclusionary criteria**
  - Not located in a floodplain
  - Not located in a park
  - Located at least 100 feet away from a body of water
  - Located at least 100 feet away from a domestic well
  - Not located in any conservation easement or preservation area
  - Located in an agricultural or industrial setting
- **Site-specfic criteria**
  - Greater than 15 acres
  - Road access

[59] Site two, located in Dickerson, MD, is a reserved 820-acre space that can be developed into a landfill, although it is currently being leased out to farmers.
[60] Zero Waste Montgomery County, "Beyond Incineration: Best Waste Management Strategies for Montgomery County, Maryland," 75, 77.

- Limited existing development on property

- **Community-specific criteria**
  - Outside an Equity Emphasis area
  - Minimize proximity to existing development

Site	Location	Coordinates	Acres	Zoning	Ownership Status
1	Darnestown, MD	39.09338, -77.30845	136.37	Agricultural	Private
2	Rockville, MD	39.14843, -77.11961	36.4	Agricultural	Private
3	Dickerson, MD	39.17810697, -77.37899708	146.27	Agricultural	Private
4	Boyds, MD	39.17968, -77.30538	53.7	Agricultural	Private

Table 3: Sites Meeting Technical Requirements for a Compost Facility

Based on these criteria, I selected four potential spots (all privately held) potentially suitable for siting a new compost facility (see appendices 1 – 5 for maps). It is important to note that while these sites meet most of the technical requirements, they may still present challenges regarding distance to existing waste infrastructure and/or may not alignment with public sentiments. More site-specific analysis would be needed to consider whether the facility could be feasibly sited. Further outreach and analysis are needed, and this inventory merely demonstrates that a facility is technically feasible given the above listed parameters. Other considerations (social, political, economic) need to be carefully weighed and the public consulted.

Recommendations

A successful organic waste recycling program will require robust education and outreach, efficient collection, and adequate processing. In the short term, opportunities to continue processing organics at the Prince George's County Facility remain viable as well as potentially working with the Devco Bioenergy Facility in Jessup, MD or Freestate Farms in Manassas, VA. In the medium- to long-term, County processing capacity should be secured. Additionally, collection efforts and waste transfer station capacity must be analyzed for feasibility. Finally, the siting of a facility must align with regulatory frameworks as well as public input.

Recommendation One: Reinforce and Bolster Distributive Composting Networks

While regional or large-scale composting facilities are needed to increase capacity in Montgomery County, a distributive approach was cited in the 2018 Composting Strategic Plan as a main priority.[61] This entails encouraging organic waste reduction and recycling at all levels, from backyard, community, institutional on-site, and on-farms composting solutions. Such an approach will help to close loops by locally managing organic waste, in turn replenishing soils, building community, and promoting environmental awareness.

The County is currently laying the groundwork for a robust distributive system. Providing increased subsidies for tools and compost bins to backyard and community composters would encourage greater diversion at the local level. Other options include developing educational opportunities like a Master Composter program, which could incorporate workshops, field trips, and service learning. New York City, among other cities and states, has a successful program that could serve as a model.[62] The On-Farm Composting Bill has created opportunities for increased composting in County, in turn improving soil health, lessening dependence on chemical fertilizers, and providing an additional revenue stream for local farmers.

[61] Department of Environmental Protection Division of Solid Waste Services, "Strategic Plan to Advance Composting, Compost Use, and Food Scraps Diversion in Montgomery County, Maryland."
[62] Refer to: "Master Composter Certificate Course," *New York City Department of Sanitation*, accessed August 6, 2022, https://www1.nyc.gov/assets/dsny/site/contact/master-composter-certificate-course

Composting in schools offers a prime opportunity to connect sustainability curriculum to practice. As organic waste diversion is established as a daily practice in the classroom or cafeteria, recycling concepts and behaviors are reinforced with students starting at a young age. On-site composting systems can help school systems to reduce waste hauling costs and potentially enrich outdoor assets, like school gardens. DEP could consider sharing resources and partnering with Montgomery County Public Schools to advance this effort.

Finally, the County could examine establishing biodigesters in select industrial spaces. These assets would potentially provide more local options for organics recycling. However, this approach would pose logistical challenges and require increased investment due to the high technology costs. Despite the logistical and financial hurdles, this approach could reduce hauling expenditures and require a smaller footprint for recycling processes.

Recommendation Two: Evaluate Single-Family Residential Food Scraps Recycling Collection Pilot

Successful organic waste recycling programs are defined by their convenience, frequency, affordability, and educational outreach.[63] Expanded County processing capacity is largely contingent upon adequate participation rates for organic waste diversion. While Montgomery County does have high recycling rates when it comes to inert materials and yard trim, organics generally tend to be diverted at lower rates. While organic waste diversion mandates could help to catalyze this process, there still needs to be public buy-in and education.

The current pilot organics curbside collection program must be analyzed for feasibility. Data collected over the next year will provide valuable information on participation rates, organic waste produced per household, and required collection frequency. DEP must determine the general feasibility as demonstrated by the pilot and decide whether the program can expand to parts of or the entire county. If the program does scale County-wide, organic waste could be hauled to a privately operated facility for processing in the short term. DEP might consider additional pilot programs that partner with schools or multifamily residences.

[63] Compost Crew, "The Municipal Guide to Residential Food Scrap Collection."

Recommendation Three: Analyze Alternatives to Increase Transfer Station Capacity

The Shady Grove Processing Facility and Transfer Station is already experiencing limited capacity. If the County expands curbside organics collection, there will need to be additional space to collect and distribute food waste at the Transfer Station. An analysis of how food scraps can be consolidated at the current site, or an auxiliary location must be conducted. DEP staff or consultants can work to determine alternatives to this situation.

Recommendation Four: Consolidate Solid Waste Subdistricts

The solid waste subdistricts were established in 1992 and sought to divide the County by population concentration and land use. The County opted to provide waste collection in densely settled areas and allowed for residents in more rural settings to arrange for their waste hauling.[64] Over the past 30 years, the two subdistricts have become more similar in population distribution and land use. The Montgomery County Office of Legislative Oversight (OLO) found that many waste hauling routes in Subdistrict B were overlapping. These inefficient routes result in increased fuel expenditures and air pollution. OLO recommended that if the County were to alter the current system, they should "expand Subdistrict A if supported by a majority of affected residents and if accompanied by an effort to allow small trash collection companies to compete for County contracts."[65] By establishing a single district, the potential roll-out of curbside organics collection could be more easily facilitated. Additionally, less frequent trash collection, expanding recycling opportunities (i.e., food scraps), and implementing a Pay As You Throw program would all help to reduce MSW.

Recommendation Five: Utilize a Community Engaged Development Process to Establish a County Composting Facility

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[64] Aron Trombka and Victoria H. Hall, "Trash and Recycling Collection: An Evaluation of Current Policies. Office of Legislative Oversight Report 2019-17" (Office of Legislative Oversight, Montgomery County, Maryland, November 12, 2019), https://www.montgomerycountymd.gov/OLO/Resources/Files/2019%20Reports/OLOReport2019-17.pdf, iii.
[65] Trombka and Hall, "Trash and Recycling Collection: An Evaluation of Current Policies. Office of Legislative Oversight Report 2019-17," V.

Based on the initial site suitability analysis, some parcels meet minimum standards for a composting facility. Determining the exact siting would have to be done in partnership with the community utilizing engagement strategies. The EPA states that the "public must be a legitimate partner in the facility siting process" and that engagement aids in "building integrity and instituting good communications with the community."[66] A best practice includes creating a siting committee composed of local stakeholders that will help in picking a location. Existing groups like the Montgomery Solid Waste Advisory Committee among other stakeholders should be involved in this process.

A commercial scale composting facility is a much more significant capital investment and would require food scrap recycling systems to be in place and operational. Further feasibility studies and engagement processes are necessary at this point. Other considerations include revisiting the proposal for food waste composting at the Dickerson Yard Trim Facility. Some groups have proposed that this is only a viable option if the MCRRF is closed, which presents compounding MSW challenges.

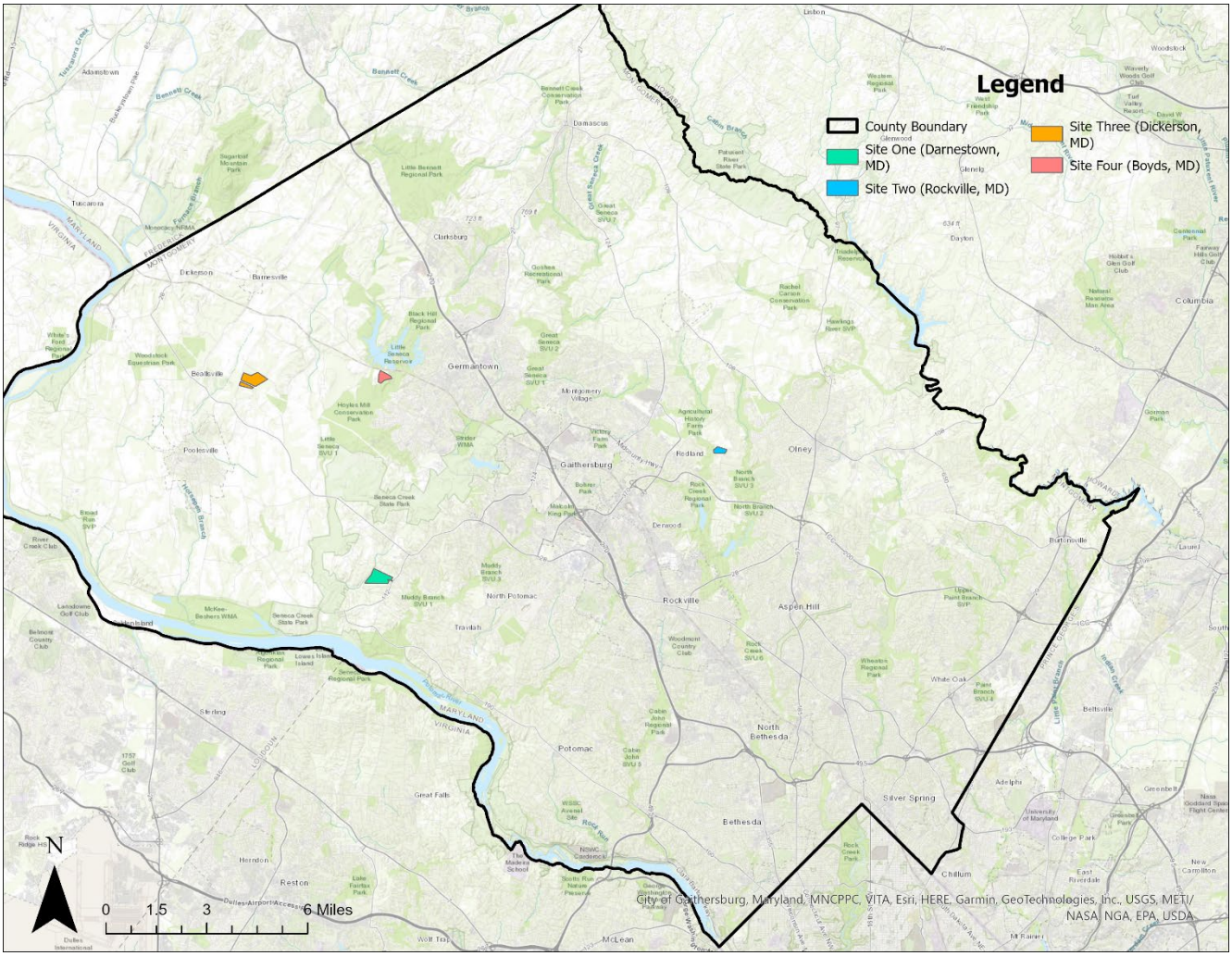
[66] Solid Waste and Emergency Response, United States Environmental Protection Agency, "Waste Transfer Stations: A Manual for Decision-Making," 11.

Conclusion

Organic waste management can promote circular systems, in turn creating economic and social capital while simultaneously promoting resilience. The future of Montgomery County's organic waste recycling presents numerous opportunities. Utilizing an equity framework that accounts for the triple bottom line (economy, society, and the environment), the County can harness existing organic waste recycling resources and infrastructure to catalyze widespread organic waste recycling.

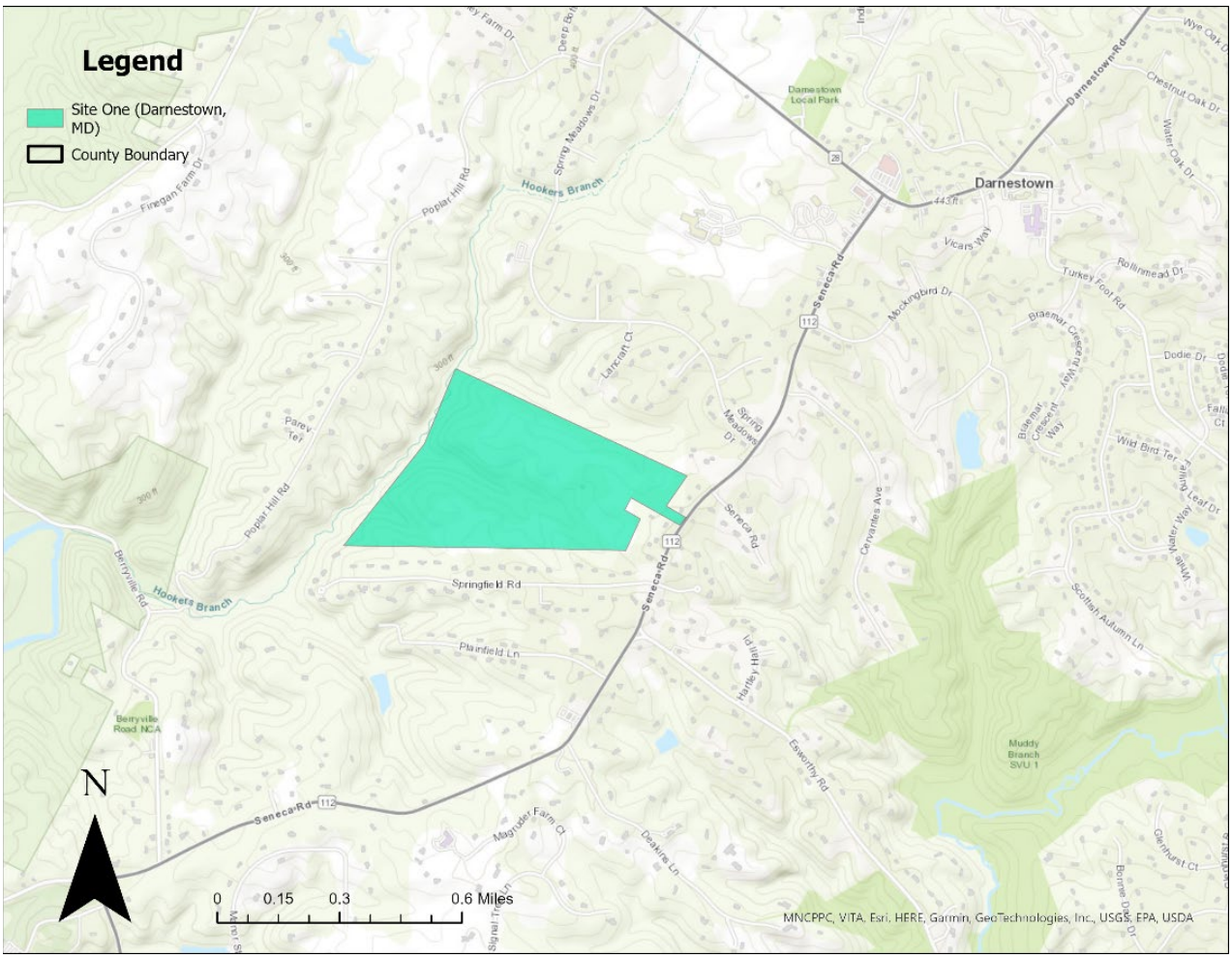
Because composting can be conducted at multiple scales, an organic waste management system will require collaboration amongst stakeholders at all levels of the distributed system. By investing in current infrastructure and examining future opportunities in partnership with the community, Montgomery County can take a step towards achieving its ambitious climate goals and take responsibility for its organic waste.

Appendix 1



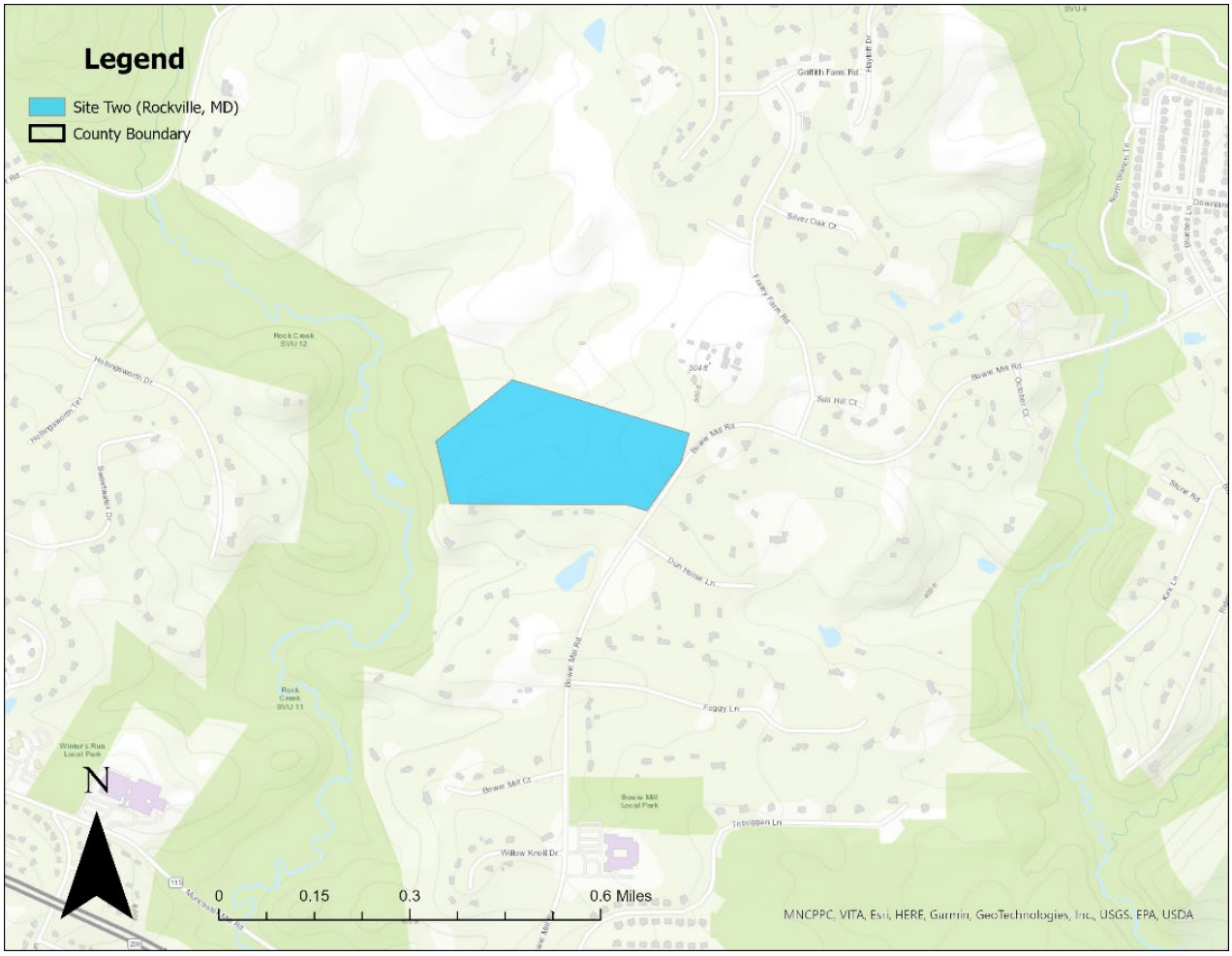
Sites potentially suitable for a composting facility (map by author). Data Source: Montgomery Planning, Montgomery County, MD. “Data Downloads: Mcp-Gismap2 Shapefiles,” n.d. https://montgomeryplanning.org/tools/gis-and-mapping/data-downloads/

Appendix 2



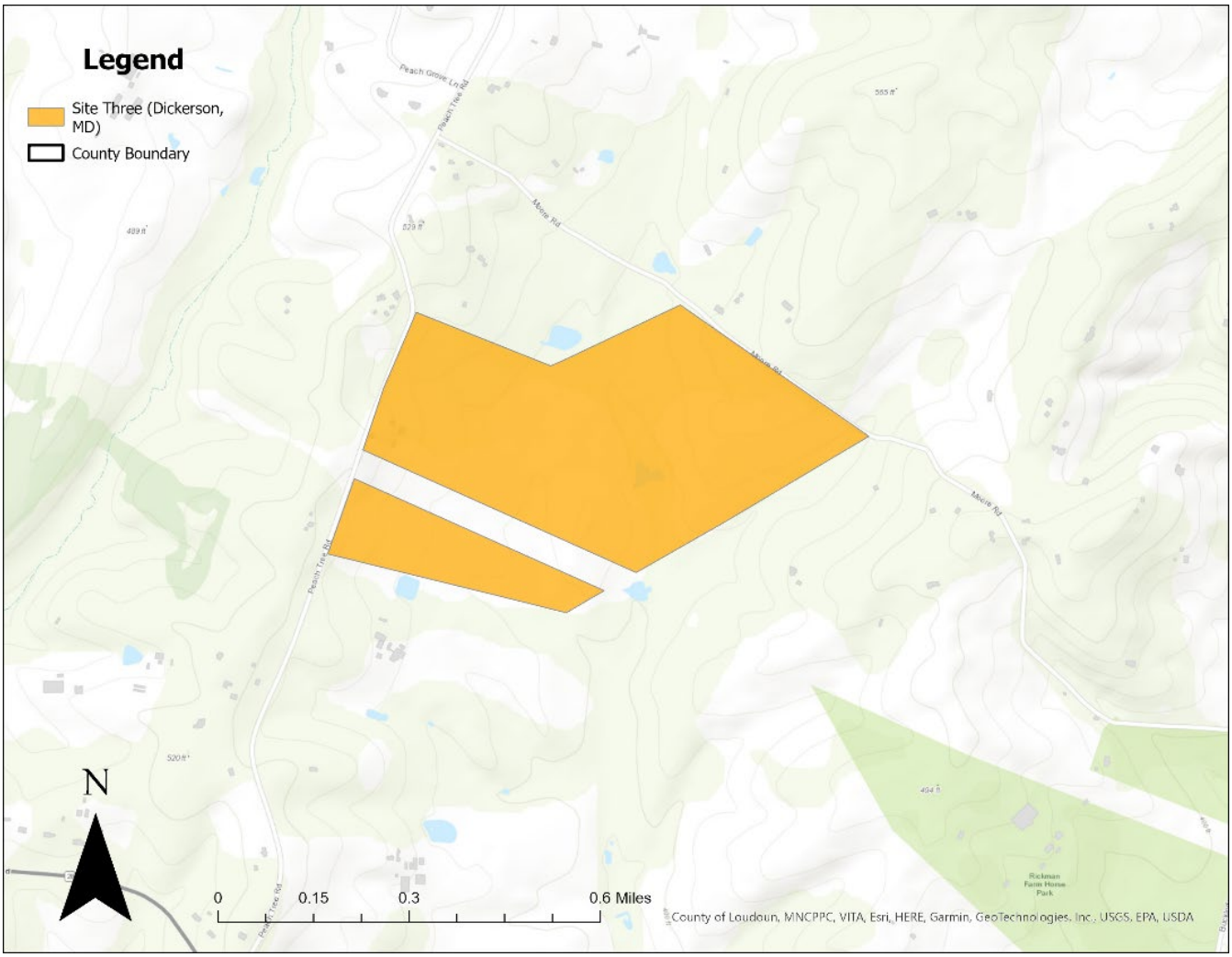
Map of site one (map by author). Data Source: Montgomery Planning, Montgomery County, MD. "Data Downloads: Mcp-Gismap2 Shapefiles," n.d. https://montgomeryplanning.org/tools/gis-and-mapping/data-downloads/

Appendix 3



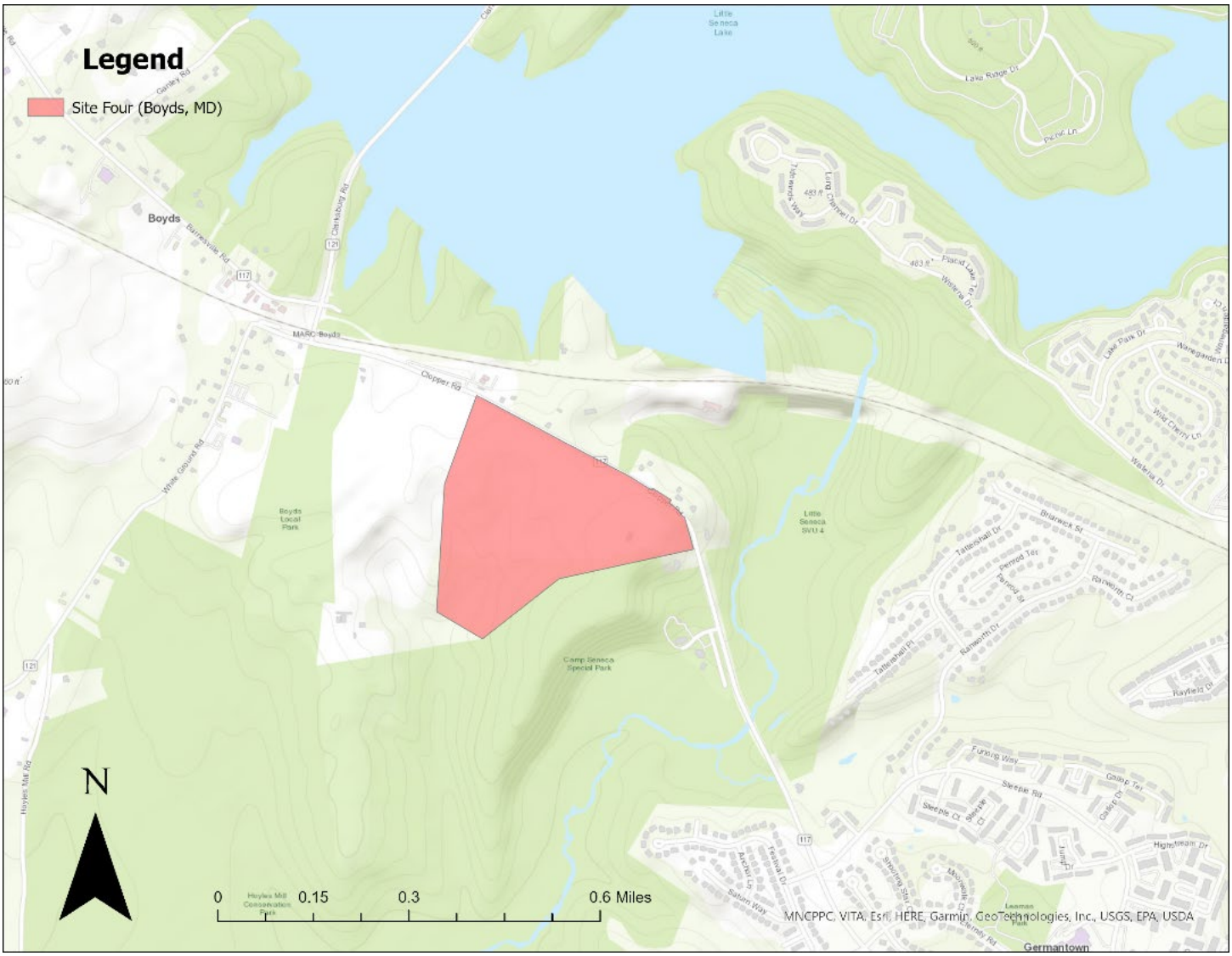
Map of site two (map by author). Data Source: Montgomery Planning, Montgomery County, MD. “Data Downloads: Mcp-Gismap2 Shapefiles,” n.d. https://montgomeryplanning.org/tools/gis-and-mapping/data-downloads/

Appendix 4



Map of site three (map by author). Data Source: Montgomery Planning, Montgomery County, MD. "Data Downloads: Mcp-Gismap2 Shapefiles," n.d. https://montgomeryplanning.org/tools/gis-and-mapping/data-downloads/

Appendix 5



Map of Site 4 (map by author). **Data Source:** Montgomery Planning, Montgomery County, MD. "Data Downloads: Mcp-Gismap2 Shapefiles," n.d. https://montgomeryplanning.org/tools/gis-and-mapping/data-downloads/.

Figures & Tables

Figure 1: EPA Food Reduction Hierarchy

United States Environmental Protection Agency. "Food Recovery Hierarchy," September 17, 2021. https://www.epa.gov/sustainable-management-food/food-recovery-hierarchy.

Figure 2: ISLR Hierarchy to Reduce Food Waste

Platt, Brenda. "Hierarchy to Reduce Food Waste & Grow Community." Institute for Local Self-Reliance, April 4, 2017. https://ilsr.org/food-waste-hierarchy/.

Figure 3: Montgomery County Organic Waste Disposal

Montgomery County Capture Model CY 2020, Montgomery County DEP.

Figure 4: MSW Collection Subdistricts in Montgomery County

Department of Environmental Protection, Division of Solid Waste Services. "Montgomery County, MD Municipal Solid Waste Collection Subdistricts and Service Areas." October 2013. https://montgomerycountymd.gov/SWS/resources/files/maps /mcsubdistrictsonlymay2014.pdf.

Figure 5: Existing Food Scrap Processing Facilities

Maryland Department of the Environment. "Composting Facilities - Permitting & Operational Status," July 2021. https://mde.maryland.gov/programs/LAND/RecyclingandOperationsprogram/ Documents/Composting%20Facilities%20with%20Capacities%202021%20.pdf.

Figure 6: The Three Phase Siting Framework for waste processing facilities.

Office of Solid Waste, Office of Policy, Planning, and Evaluation, U.S. Environmental Protection Agency. "Sites for Our Solid Waste: A Guidebook for Effective Public Involvement," 1990. https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=10001ABQ.txt

Figure 7: Levels of Involvement by Various Segments of the Public

Office of Solid Waste, Office of Policy, Planning, and Evaluation, U.S. Environmental Protection Agency. "Sites for Our Solid Waste: A Guidebook for Effective Public Involvement," 1990. https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=10001ABQ.txt

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Maryland Department of the Environment. "Composting Facilities - Permitting & Operational Status," July 2021. https://mde.maryland.gov/programs/LAND/RecyclingandOperationsprogram/Documents/Composting%20Facilities%20with%20Capacities%202021%20.pdf.

Table 2: Modified Spectrum of Participation

Nabatchi, Tina. "A Manager's Guide to Evaluating Citizen Participation." Fostering Transparency and Democracy Series. IBM Center for the Business of Government, 2012. https://www.businessofgovernment.org/sites/default/files/A%20Managers%20Guide%20to%20Evaluating%20Citizen%20Participation.pdf.

Table 3: Sites Meeting Technical Requirements for a Compost Facility (table by author)

Bibliography

AECOM, Inspiregreen. "Montgomery County Climate Action Plan: Building a Healthy, Equitable, Resilient Community." Montgomery County Government, June 2021. https://www.montgomerycountymd.gov/green/Resources/Files/climate/climate-action-plan.pdf.

Altamirano, Juan-Carlos, Anne Maassen, and Olivia Prieto. "Moving Beyond 'Take, Make, Waste': Developing Cities Show the Possibilities of the Circular Economy." World Resources Institute, October 2, 2017. https://www.wri.org/insights/moving-beyond-take-make-waste-developing-cities-show-possibilities-circular-economy.

Bullard, Robert D. "Environmental Justice: It's More Than Waste Facility Siting." Social Science Quarterly 77, no. 3 (September 1996): 493–99.

"Code of Maryland Regulations: Composting Facility Siting and Design Requirements," April 6, 2021. http://mdrules.elaws.us/comar/26.04.11.08.

"Code of Maryland Regulations: Sec. 26.04.11.04. General Restrictions and Specifically Prohibited Acts," April 6, 2021. http://mdrules.elaws.us/comar/26.04.11.04.

"Code of Maryland Regulations: Sec. 26.04.11.05. Permits Required," April 6, 2021. http://mdrules.elaws.us/comar/26.04.11.05.

Coleman-Jensen, Alisha, Matthew P. Rabbitt, Reem N. Hashad, Laura Hales, and Christian A. Gregory. "Food Security in the U.S.: Key Statistics & Graphics." U.S. Department of Agriculture Economic Research Service, April 22, 2022. https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-u-s/key-statistics-graphics/#:~:text=Food%2Dinsecure%20households%20include%20those, from%2010.5%20percent%20in%202019.

Compost Crew. "The Municipal Guide to Residential Food Scrap Collection," 2020. https://drive.google.com/file/d/1KaM4cwdWY9qn46glDMWF8L4_RmfXwJLH/view.

Department of Environmental Protection Montgomery County, Maryland. "Reduce, Reuse and Recycle Right!" Accessed August 2, 2022. https://www.montgomerycountymd.gov/SWS/recycle-right/index.html?

utm_source=websitewastereduction&utm_medium=banner&utm_campaign=RRR2021&utm_content=rrrbanner.

Department of Environmental Protection. "Comprehensive 10-Year Solid Waste Management Plan CY 2020 - CY 2029 Montgomery County, Maryland," October 2021. https://www.montgomerycountymd.gov/SWS/Resources/Files/swp/solid-waste-plan.pdf.

Department of Environmental Protection Division of Solid Waste Services. "Strategic Plan to Advance Composting, Compost Use, and Food Scraps Diversion in Montgomery County, Maryland." Montgomery County Government, April 2018. https://www.montgomerycountymd.gov/SWS/Resources/Files/foodwaste/Strategic%20Plan%20to%20Advance%20Composting%2C%20Compost%20Use%2C%20and%20Food%20Scraps%20Diversion%20in%20Montgomery%20County%2C%20MD.pdf.

Digital.gov. "U.S. Public Participation Playbook." Accessed August 6, 2022. https://digital.gov/guides/public-participation/.

Harris, Smariga and Associates, INC. "Facilities Master Plan for the Solid Waste Operations in the Dickerson Area," August 2013. https://www.montgomerycountymd.gov/SWS/Resources/Files/dafig/dickerson-facilities-master-plan.pdf.

Institute for Local Self-Reliance. "Maryland HB 1070 Solid Waste Disposal and Diversion and On-Farm Composting and Compost Use." Accessed August 6, 2022. https://cdn.ilsr.org/wp-content/uploads/2022/02/HB-1070-Fact-Sheet.pdf

Jones, Sophia. "Maryland - Montgomery County Ag Zoning Amendment." Institute for Local Self-Reliance, July 9, 2021. https://ilsr.org/rule/on-farm-composting/maryland Montgomery county/#:~:text=In%20February%202021%2C%20the%20Montgomery,for%20producing%20compost%20or%20mulch.

Land and Materials Administration, Maryland Department of the Environment. "Maryland Solid Waste Management and Diversion Report 2021 (CY20 Data)," 2021. https://mde.maryland.gov/programs/land/Documents/MD%20Solid%20Waste%20Management%20and%20Diversion%20Report%20CY20%20%281%29.pdf.

Maryland Department of the Environment. "Composting Facilities - Permitting & Operational Status," July 2021. https://mde.maryland.gov/programs/LAND/RecyclingandOperationsprogram/Documents/Composting%20Facilities%20with%20Capacities%202021%20.pdf.

Maryland Department of the Environment. "Guidance for Maryland Composting Facilities," July 2014. https://cc.howardcountymd.gov/LinkClick.aspx?fileticket=eT1gfx6yKlo%3D&portalid=0.

Maryland Environmental Service. "Food Waste Composting." Accessed August 2, 2022. https://menv.com/service/food-waste-composting/.

Miller Davis, Susan, Amanda Hong, Mihir Mathur, Jon Schroeder, and Chad Frischmann. "Reduced Food Waste." Project Drawdown. Accessed August 6, 2022. https://drawdown.org/solutions/reduced-food-waste.

Montgomery Planning, Montgomery County MD. "The Equity Focus Areas Analysis," July 13, 2022. https://montgomeryplanning.org/planning/equity-agenda-for-planning/the-equity-focus-areas-analysis/.

Nabatchi, Tina. "A Manager's Guide to Evaluating Citizen Participation." Fostering Transparency and Democracy Series. IBM Center for the Business of Government, 2012. https://www.businessofgovernment.org/sites/default/files/A%20Managers%20Guide%20to%20Evaluating%20Citizen%20Participation.pdf.

New York City Department of Sanitation. "Master Composter Certificate Course." Accessed August 6, 2022. https://www1.nyc.gov/assets/dsny/site/contact/master-composter-certificate-course.

Office of Resources Conservation and Recovery, Program Management, Communications, and Analysis Office. "RCRA Orientation Manual 2014." Washington, D.C.: United States Environmental Protection Agency, 2014. https://www.anthc.org/wp-content/uploads/2015/12/IEH_RCRA_Orientation_Manual_2014.pdf.

Office of Solid Waste, Office of Policy, Planning, and Evaluation, U.S. Environmental Protection Agency. "Sites for Our Solid Waste: A Guidebook for Effective Public Involvement," 1990. https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=10001ABQ.txt

Pforzheimer, Adrian, and Alexander Truelove. "Trash in America: Moving from Destructive Consumption towards a Zero-Waste System." Frontier Group; US PIRG, September 2021. https://environmentamerica.org/sites/environment/files/reports/US_Trash%20in%20America%202021-SCRN.pdf.

Platt, Brenda. “Hierarchy to Reduce Food Waste & Grow Community.” Institute for Local Self-Reliance , April 4, 2017. https://ilsr.org/food-waste-hierarchy/.

Platt, Brenda. “State of Composting in U.S.” June 26, 2015. https://cdn.ilsr.org/wp_ilsr/wp-content/uploads/2015/07/brenda-platt-2015-composting-presentation.pdf.

Platt, Brenda, and Nora Goldstein. “State Of Composting In The U.S.” Biocycle, July 16, 2014. https://www.biocycle.net/state-of-composting-in-the-u-s/.

Schere, Dan. “If County Shuts Trash Incinerator, What Next?” Bethesda Magazine, February 5, 2019, sec. Government. https://bethesdamagazine.com/bethesda-beat/government/if-county-shuts-trash-incinerator-what-next/.

Scotto, Annette, Andrea Ramirez, and Christine Roarke. “Aiming for Zero Waste Montgomery County Maryland: Baseline Review and Current State Assessment.” HDR, December 2018. https://www.montgomerycountymd.gov/SWS/Resources/Files/master-plan/current-assessment.pdf.

Sherman, Rhonda. “Large-Scale Organic Materials Composting.” NC State Extension, January 16, 2022. https://content.ces.ncsu.edu/large-scale-organic-materials-composting.

Sierra Club. “Sierra Club Zero Waste Policy.” Accessed August 2, 2022. https://www.sierraclub.org/sites/www.sierraclub.org/files/Sierra%20Club%20Zero%20Waste%20Policy%20December%202019.pdf.

Sierra Club Montgomery County, Maryland. “Recommendation for Achieving Zero Waste in Montgomery County.” April 2020. https://www.sierraclub.org/sites/www.sierraclub.org/files/sce/montgomery-county/zero_waste/April%202020%20Sierra%20Club%20MC%20Zero%20Waste%20Recommendations.pdf.

Solid Waste and Emergency Response, United States Environmental Protection Agency. “Waste Transfer Stations: A Manual for Decision-Making,” June 2002. https://www.epa.gov/sites/default/files/2016-03/documents/r02002.pdf.

Target Organics. “Factors to Consider in Evaluating Potential Sites,” August 6, 2022. https://hub.compostingcouncil.org/factors-to-consider-in-evaluating-potential-sites/.

Trombka, Aron, and Victoria H. Hall. “Trash and Recycling Collection: An Evaluation of Current Policies. Office of Legislative Oversight Report 2019-17.” Office of Legislative Oversight,

Montgomery County, Maryland, November 12, 2019. https://www.montgomerycountymd.gov/OLO/Resources/Files/2019%20Reports/OLOReport2019-17.pdf.

United States Environmental Protection Agency. "Composting At Home," July 7, 2022. https://www.epa.gov/recycle/composting-home.

United States Environmental Protection Agency. "Clean Water Act (CWA) and Federal Facilities," January 20, 2022. https://www.epa.gov/enforcement/clean-water-act-cwa-and-federal-facilities.

United States Environmental Protection Agency. "Clean Water Act, Section 402: National Pollutant Discharge Elimination System," December 6, 2021. https://www.epa.gov/cwa-404/clean-water-act-section-402-national-pollutant-discharge-elimination-system.

United States Environmental Protection Agency. "Criteria for the Definition of Solid Waste and Solid and Hazardous Waste Exclusions," July 31, 2022. https://www.epa.gov/hw/criteria-definition-solid-waste-and-solid-and-hazardous-waste-exclusions.

United States Environmental Protection Agency. "Downstream Management of Organic Waste in the United States: Strategies for Methane Mitigation," January 2022. https://www.epa.gov/system/files/documents/2022 01/organic_waste_management_january2022.pdf.

United States Environmental Protection Agency. "Public Participation Guide: Introduction to Public Participation," February 17, 2022. https://www.epa.gov/international-cooperation/public-participation-guide-introduction-public-participation.

United States Environmental Protection Agency. "RCRA's Critical Mission & the Path Forward," June 2014. https://www.epa.gov/sites/default/files/2015-09/documents/rcras_critical_mission_and_the_path_forward.pdf.

United States Environmental Protection Agency. "Sustainable Materials Management: Non-Hazardous Materials and Waste Management Hierarchy," July 5, 2022. https://www.epa.gov/smm/sustainable-materials-management-non-hazardous-materials-and-waste-management-hierarchy.

United States Environmental Protection Agency. “Types of Composting and Understanding the Process,” April 21, 2022. https://www.epa.gov/sustainable-management-food/types-composting-and-understanding-process#aeratedstatic.

Zero Waste Montgomery County. “Beyond Incineration: Best Waste Management Strategies for Montgomery County, Maryland,” 2021. http://www.energyjustice.net/md/beyond.pdf.