



A NEAR ZERO SOLID WASTE STRATEGY

TOWN OF MAMARONECK, NEW YORK

AUTHORS

Stacy Kotorac (Manager),
Mary Jo Burke (Deputy Manager),
Carl Cangelosi, Rane Cheung,
Eliav Levy, Padma Mahadevan,
Tamma Mohapatra, James Ossman,
Monalisa Prasad, Kelli Stephens

ADVISOR

Susanne DesRoches



THE EARTH INSTITUTE
COLUMBIA UNIVERSITY

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The capstone workshop is a client-based consulting project that students undertake to address critical sustainability management issues. The workshop is specially designed to integrate the program's distinct curriculum areas, including: integrative sustainability management, economics and quantitative analysis, environmental sciences, engineering, and planning, general and financial management, and public policy.

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EXECUTIVE SUMMARY

Background

Waste reduction has become a critical issue in recent years in Mamaroneck, New York, as policymakers seek new strategies to balance the community's environmental sustainability with economic prosperity. There is significant potential to affect positive change throughout the community and encourage more sustainable behavior changes for all residents, while also driving cost savings for residents, businesses, and the Mamaroneck itself.

The Town of Mamaroneck (the Town) currently has a high recycling rate of 63%, the 8th best in Westchester County (the County). The Town is looking to increase this rate through the development of a Near Zero Waste program and tasked the Capstone team with developing recommendations that will move the Town closer to the goal of reducing the financial and environmental impacts of its current solid waste management system.

Before recommendations could be developed, an examination of Mamaroneck's current solid waste management system was necessary to understand its operating structure, what waste is and is not collected, the composition of the waste, and how the discarded waste and recycled materials are processed at both the Town and County levels. This work also included an examination of Westchester County regulations and its effects on the waste management operations of Mamaroneck.

Research was conducted to understand the best solid waste management practices in municipalities both in the United States and in other countries. Benchmarking these cities provided a foundation to determine which waste reduction programs could provide Mamaroneck with the greatest waste reduction impact. Once programs were identified, a cost benefit analysis was done for each recommendation to assess its feasibility from a cost standpoint. Costs were determined through a cost-benefit analysis that looked at net revenues over a five-year period.

In order to provide recommendations for Mamaroneck, the goal of Near Zero Waste had to be defined. The Zero Waste definition used by the U.S. Zero Waste Business Council and the Zero Waste International Alliance states that a business or community that diverts at least 90% of its solid waste from landfills and incinerators qualifies as achieving Zero Waste. Mamaroneck does not send any of its discarded waste to landfills. Instead, it is all sent to a waste-to-energy facility, thus requiring the definition to be adjusted. To achieve its goal of Near Zero Waste, Mamaroneck will need to divert 90% of its solid waste from the waste-to-energy facility by 2018.

Opportunities exist within the Town's current waste management structure to increase the recycling rate. When these are coupled with new programs to divert recyclable materials that are not currently

separated, the Town will move closer to its Near Zero Waste goal. Based on analysis and best practices from similar cities, the recommendations were developed for Mamaroneck in two categories; the first includes programs to remove textiles and food waste from the discarded waste stream, while the second seeks to improve existing programs for residents by increasing recycling rates through communication, education, and financial incentives.

Each recommendation was assessed over a five-year implementation timeframe and based on three criteria:

- 1) Potential waste reduction impact;
- 2) Estimated net cost or offsetting revenue that would be incurred over a five-year period as determined through a simplified cost benefit analysis;
- 3) Feasibility of implementation within various political and socioeconomic constraints faced by the Commission.

Recommendation Summary

The recommendations developed for the Town of Mamaroneck are summarized below. The revenue and waste impact data are all based on a five-year period. Net revenues are the sum of the cumulative costs and offsetting revenues associated with the project over a five-year period.

Conduct a Municipal Waste Audit

Mamaroneck has not conducted a detailed solid waste audit. For this project, the potential waste reduction for each recommendation was based on estimated data derived from the EPA's national waste audit. Data from a waste audit will provide the actual composition of the Town's waste stream, as well as baseline information for its Near Zero Waste goal. It will also verify the estimates used to develop the recommendations. The waste reduction and revenue impact from this recommendation will depend on the type of audit selected and the findings from the audit.

Textile Diversion

Textiles are estimated to represent 8% of Mamaroneck's discarded waste stream. Clothing bins, carpet collection trailers, and onsite collection services could collect and recycle clothing, textiles, and carpet.

Waste Reduction Impact: 1%

Net Revenue: \$143,000

Food Waste Diversion

Food waste represents an estimated 21% of the Town's annual waste stream. Numerous programs were evaluated to divert food from discarded waste. Three programs were chosen as recommendations for the Near Zero Waste strategy – backyard composting, residential drop-off collection, and food waste collection in schools.

Waste Reduction Impact: 2%

Net Cost: (\$310,000)

Improving Existing Recycling Programs

Recyclable materials account for approximately 48%, or almost half, of Mamaroneck's discarded waste stream. Three programs to increase recycling rates of these materials are recommended - build a recycling culture in multi-family homes, "Oops" sticker enforcement, and student involvement and recycling education in schools.

Waste Reduction Impact: 3%

Net Revenue: \$41,000

Pay-As-You-Throw Municipal Solid Waste Program

A Pay-As-You-Throw program typically increases recycling rates by 32-59% and reduces discarded solid waste by 14-17%. This is achieved through a financial incentive to residents to reduce the amount of their discarded waste.

Waste Reduction Impact: 6%

Net Revenue: \$4,000,000

Implementation

All programs are recommended to be in place within two years. While each program recommendation provides waste reduction impact on its own, the staggered implementation plan ensures that programs are in place to capture "new" discarded waste stream materials before the start of Pay-As-You-Throw, the recommendation with financial impacts to residents.

Total Waste Reduction Impact: 0%

Net Cost: \$290,000

Total Waste Reduction Impact for all Recommendations: 12%

Total Offsetting Revenue from all Recommendations: \$3.9 million

Communications

Communication with Mamaroneck residents about the Near Zero Waste programs is essential to achieve the greatest waste reduction impact of the recommendations. The communication strategy will inform and educate residents about the different programs, encourage behavior change, and champion success stories. Communication will happen across many fronts, such as in-person community meetings, mailings, Town website updates, education forums, and social media campaigns. It also includes a collection of case studies and best practices in communicating the programs recommended in Mamaroneck's Near Zero Waste strategy.

Closing the Gap

The five recommendations developed for the Town of Mamaroneck will not get the Town to its Near Zero Waste goal. The maximum waste impact potential is 12%, less than half of the necessary

27% reduction needed to achieve 90% diversion of discarded waste from the waste-to-energy-facility. These recommendations serve as a strong foundation for more effective waste management in the short term. Over the longer term, there are a number of other opportunities the Town can employ to further reduce the gap. The Town could utilize the findings of a waste audit to ensure it is focusing on the programs with the highest potential impact on the waste stream. In addition, the town could focus on the participation rate throughout the community and increase the scale of the programs. Lastly, the Town can explore operational changes, such as switching to a single stream system, that collect more recyclables or make it easier for residents to recycle.

GLOSSARY OF TERMS

- **Curbside Recycling:** Bins containing recyclables that are left at curbside for pickup.
- **Deposit cans and bottles:** All recyclable containers deposited at drop off points.
- **Discarded waste:** Solid waste that is sent to the County's waste-to-energy facility
- **Diversion:** The prevention and reduction of generated waste through source reduction, recycling, reuse, or composting;¹ for Mamaroneck, this is solid waste that is not sent to the waste-to-energy facility.
- **EPA:** United States Environmental Protection Agency.
- **Food waste:** Edible items that are not consumed and end up in the solid waste stream.
- **Sustainability:** Ensuring the availability of natural resources for present generations to meet their needs without compromising the ability of future generations to meet their needs.²
- **Tipping fee:** Fee paid by the Town for disposal of waste in the County's waste-to-energy facility.
- **Town:** Geographic boundary serviced by the Larchmont-Mamaroneck Joint Sanitation Commission (the Commission), i.e., Town of Mamaroneck and Village of Larchmont.
- **WtE:** Energy recovery from waste is the conversion of non-recyclable waste materials into useable heat, electricity, or fuel through a variety of processes, including combustion, gasification, pyrolyzation, anaerobic digestion, and landfill gas (LFG) recovery. This process is often called waste-to-energy (WtE).³
- **Yard waste:** Grass clippings, branches, dead plants, etc.⁴

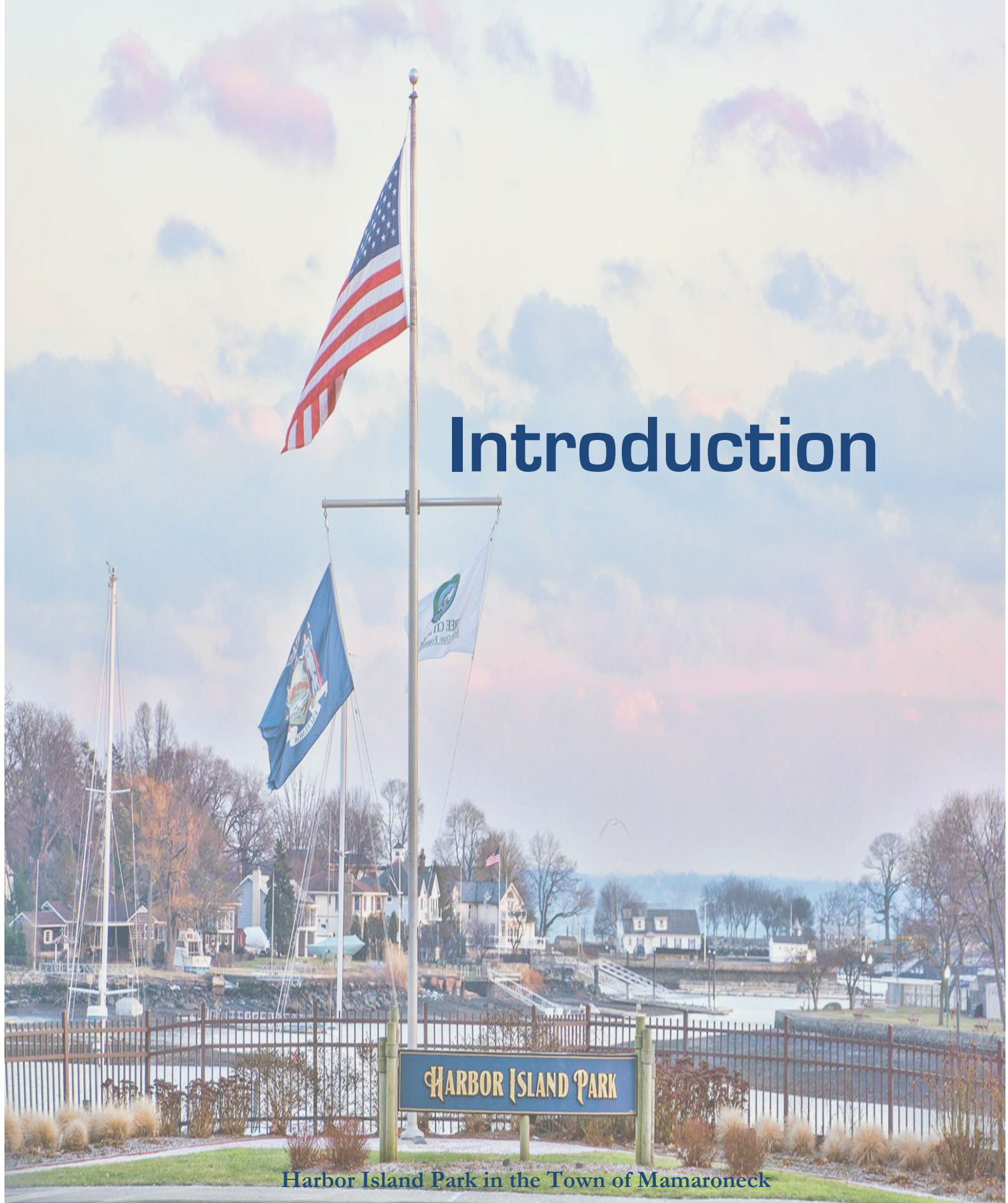
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Introduction



Harbor Island Park in the Town of Mamaroneck

Project Scope

Mamaroneck's waste strategy and reducing its associated economic and environmental costs have become a priority for residents and town officials. Volunteer residents in the Mamaroneck Sustainability Collaborative are prioritizing sustainable waste management practices in the sustainability plan they are developing for the Town. Town officials recognize the potential benefits from reducing both the costs for the Town and the associated taxes charged to residents who pay for the waste collection. These stakeholders recognize that more sustainable waste options make financial sense and reduce environmental impacts.¹ The project seeks to develop this for the Town in the form of a Near Zero Waste strategy to address all of the service areas where the Commission collects and treats solid waste.

Mamaroneck is located in Westchester County and currently pays the County a tipping fee for all of the solid waste that is collected within its geographic boundaries. As this project's analysis will show, between 2,266 tons and 2,579 tons of the waste that is currently discarded could be more sustainably managed. The recommendations in this report offer strategies to reduce the Town's total solid waste generated, save money by reducing tipping fees paid to the County, and minimize the environmental impacts resulting from the disposal of the waste.

Profile of Mamaroneck

Client

The client for this project is the Town of Mamaroneck, with management and work facilitated by the Mamaroneck Sustainability Collaborative. The Collaborative is a group of volunteer residents who advise Town policymakers on strategies to reduce the community's environmental impacts and prepare for future local, state, and federal environmental regulations while keeping the tax impact low for Town residents and businesses.² The Collaborative approached the Earth Institute's Master of Science in Sustainability Management program to develop a Near Zero Waste strategy for the Town. The client aims to incorporate this strategy into their formulation of a Mamaroneck sustainability plan.

Background

The Town of Mamaroneck is a suburb of New York City located in Westchester County in the State of New York. It contains three geographic areas: the Town of Mamaroneck's unincorporated area, the Village of Larchmont, and the Village of Mamaroneck. A map of the three areas is included in Appendix 1. The Larchmont-Mamaroneck Joint Sanitation Commission (Commission) is responsible for solid waste management and collection only for the Town of Mamaroneck and the Village of Larchmont. The Village of Mamaroneck has its own solid waste management operations, which is outside the scope of this project.

The Commission services a population of approximately 18,462.³ The median household income in the Town is \$108,000, which is more than double the 2013 national average of \$51,939.⁴

Waste collection occurs for all single-family homes, multi-family homes, four of the six schools, public buildings, and commercial buildings. It does not service non-residential buildings that produce more waste than can be hauled within the Commission's existing two-day-per-week pickup schedule.

Previous Commission Initiatives

Mamaroneck has had a recycling program in place since for over 40 years; newspaper recycling began in 1971, bottle and can recycling started in 1994, and yard waste recycling began in 1999.⁵ In October 2013, the Village of Larchmont attempted to implement new waste management initiatives including a ban on plastic bags, which would have made it the third municipality in Westchester to do this, following the Village of Mamaroneck and City of Rye.⁶ Due to legal challenges, this initiative did not move forward, and the Commission has since focused its attention on other waste management strategies.

In 2009, the Town adopted the Climate Smart Communities (CSC) Pledge. CSC is a program in New York State that helps communities reduce their greenhouse gas emissions, prepare for future climate change impacts, and save money. Before the Pledge was adopted, the Town had already implemented a number of programs addressing energy, green fleet, stormwater management, stakeholder engagement and education, and waste reduction, all of which are elements of the Pledge.⁹

In 2013, the Town had the eleventh highest-performing recycling program in Westchester County.¹⁰

Mamaroneck's "Veggie" Truck

In 2008, the Town converted one of its garbage trucks to run on vegetable oil collected from local restaurants. Before this program, restaurants had to pay for this waste product to be collected and discarded. The Town now provides restaurants with the oil containers, collects them at no charge to the restaurants, and strains the oil to be used as biofuel. The cost to convert the truck was \$7,000. The Commission converted a second truck in 2010⁷. The engine conversions both took place after the 5-year warranty on the engines expired, at which point it was economically feasible to retrofit the engine to run on cooking oil. In 2011, Town Administrator Steve Altieri estimated that the fuel cost savings for the two trucks were approximately \$20,000-\$25,000 per year, generating a quick payback for the Town. This program has subsequently increased the value of the cooking oil in the community and the Town now faces competition for the oil from private vendors who are willing to pay the restaurants to pick up their oil and use it for other purposes.⁸

Mamaroneck’s Current Solid Waste Collection

Figure 1 provides a visual representation of the key waste streams within the scope of the project. This waste map provides an overview of the Town’s current waste streams and a visualization of the entities involved in handling the Town’s waste. The waste map helps to differentiate the waste streams managed by the Commission from those that are not under the Commission’s jurisdiction and are therefore outside the scope of the project. The waste map indicates that recyclable materials are currently being discarded with non-recyclables and have the potential to be diverted. This was the inspiration for the recommendations regarding improving existing recycling programs, which is discussed later in the Recommendations chapter.

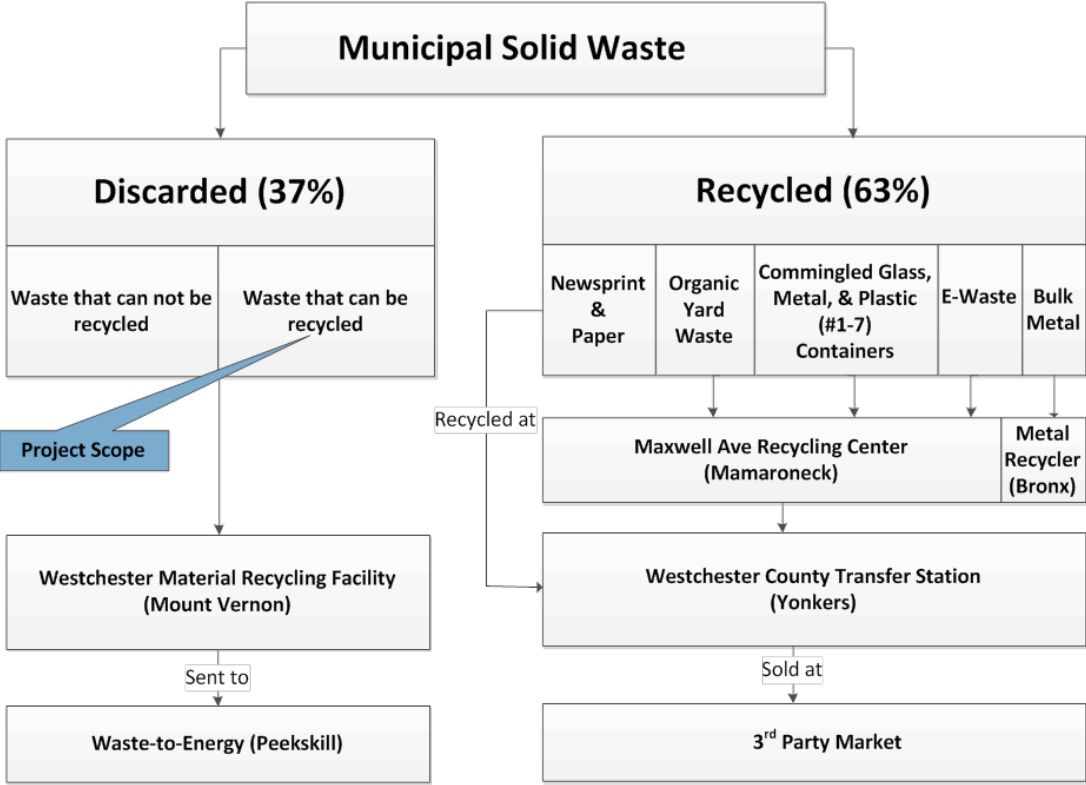


Figure 1: Town Waste Map

The Town is divided into two separate service areas, both of which are managed by the Commission. Each has its own non-recyclable solid waste pickup on either Monday and Thursday or Tuesday and Friday. A map of the different sanitation routes is included in Appendix 1. Rubbish, which the Commission defines as furniture, paint cans, etc., is picked up on Thursday from one part of the service area and on Friday from the other. Yard waste, which includes leaves, grass clippings, and plant trimmings, is also picked up on these days during the months of April through October. Yard waste pickup continues from the middle of October to the middle of December but under the jurisdiction of the Highway Department, rather than the Commission.¹¹

Recycling pickup takes place every Wednesday and is commingled for plastic, glass, and metal containers. These materials are transported to the recycling facility in Yonkers. All plastics #1-7 are recyclable, however the Commission does not have the capacity to recycle plastic bags, rigid plastics, toys, bulk metal, paint cans, metal hangers, silverware, pane glass, or glassware. Paper and cardboard materials are required to be placed in a separate recycling bin with all extraneous adhesives and staples removed. The Commission does not provide e-waste pickup. Residents are encouraged to donate or sell old electronic devices, or they may bring them to either the Maxwell Avenue recycling center or the Household Material Recovery Facility in Valhalla. Residential waste is picked up from the back of the house and bins are returned to that spot.¹²

The Westchester County Department of Environmental Facilities (DEF) serves as planning unit for Westchester's 43 municipalities. It manages Refuse Disposal District (RDD) No. 1, which covers 36 of the county's municipalities, including Mamaroneck.¹³ Each municipality covered by RDD No. 1 entered into an Agreement in 2010 for an initial term of ten years.¹⁴ Under the Agreement, the county is responsible for providing disposal of solid waste, recyclables, organic waste, electronics, and hazardous waste.¹⁵ The Agreement guarantees a tipping fee rate per ton of garbage and per ton of organic waste. In Mamaroneck, these fees are paid out of the budget of the Commission¹⁶. The tipping fee is consistent among all municipalities within the RDD No. 1 and is adjusted every year based on the Consumer Price Index. The Agreement however does not govern the amount of waste any municipality discards and it is legally mandated that all municipal solid waste is collected and transferred to the County's transfer station.

Discarded solid waste from the Town is trucked to the Charles Point Resources Recovery Facility operated by Wheelabrator Westchester, L.P., located in Peekskill, New York. This facility accepts municipally and privately collected solid waste to be converted into electricity, which is returned to the electrical grid. The facility processes 2,250 tons of solid waste per day and generates 60 MW. It uses a magnetic system to remove ferrous metals from the ash generated through the waste-to-energy (WtE) conversion process.¹⁷

Trade-Offs of Different Waste Disposal Methods

All of the discarded waste from Mamaroneck is sent to a WtE facility. Typical municipal solid waste disposal methods refer to landfills, incinerators, and WtE facilities. The U.S. Environmental Protection Agency (EPA) recommends the following waste management hierarchy in order of descending overall environmental benefits: source reduction and reuse, recycling/composting, energy recovery, treatment, and disposal.¹⁸

Source reduction and reuse promote reducing waste at its source. This can be done through donating items that have not reached their end of life, reusing and repurposing, and purchasing products that incorporate these features. Recycling involves the collection of used items that would otherwise be considered waste and processing the recyclable materials into reusable products.

Recycling conserves natural resources, reduces the amount of virgin raw materials needed, reduces the need for treatment and disposal of recyclable materials, and reduces greenhouse gas (GHG) emissions and water pollutants.

The EPA describes converting non-hazardous waste materials into electricity (WtE) as a renewable source of energy for two reasons.¹ The first reason is that the energy produced in a WtE facility offsets fossil fuels in the overall energy mix, thereby avoiding GHG emissions associated with the fossil fuels. The second reason is the reduced methane pollution in landfills resulting from reduced solid waste volumes transported there.¹⁹ WtE facilities, however, are expensive to build and produce ash at the end of the conversion process that has to be landfilled.

For waste that cannot be reduced, reused, recycled, or converted to energy, treatment and disposal options generally include landfills or incinerators. Landfills are engineered areas where municipal solid waste is discarded. While landfills are stringently regulated and monitored by local and federal governments, the decomposing waste in landfills emits GHGs that pollute the air and creates stormwater runoff that pollutes the water supply. Incineration involves combusting the waste in high temperatures and converts the waste into ash. While incinerators can reduce waste to approximately 10% of its original volume thereby reducing the land required for waste disposal, incinerators also produce toxins such as dioxins, produce carbon dioxide and methane that contribute to GHG emissions, and are highly energy-intensive processes.²⁰ Currently the Town does not send any waste to landfills or incinerators.

Given the environmental disadvantages of energy recovery discussed above, landfills, and incinerators, waste management principles should encourage waste reduction, recycling, and ultimately, energy recovery. Recycling is also inherently less energy-intensive than WtE facilities. The energy conserved by recycling exceeds the electricity generated at WtE facilities.²¹ Therefore, while developing a Near Zero Waste strategy for the Town, reducing, reusing, and recycling waste generated to the maximum extent possible, and thereby diverting it from the WtE facility, are prioritized.

Objective: Defining “Near Zero Waste”

Developing a Near Zero Waste strategy required a thorough understanding of the concept of “Near Zero Waste” and defining what this could mean for Mamaroneck. Definitions from leading organizations such as U.S. Zero Waste Business Council and the Zero Waste International Alliance were consulted. These definitions were combined with the understanding of Mamaroneck’s current waste management system and community context to ensure the definition could be timely, accurate, and achievable within the constraints of the Town’s boundaries and control.

¹ Defined as separated yard waste or food waste, including recycled cooking and trap grease, and materials described in §80.1426(f)(5)(i). Final regulations allow separated municipal solid waste (after all recyclable materials have been removed) to qualify as “separated yard or food waste”

The U.S. Zero Waste Business Council and the Zero Waste International Alliance typically define Zero Waste as diverting at least 90% of solid waste from landfills and incinerators.^{22,23} The Town does not have control over the products that are consumed and disposed of within its jurisdiction which impacts the Town's ability to ensure packaging materials are recyclable. To overcome these challenges, cities such as San Francisco have an 'Extended Producer Responsibility' policy, in which manufacturers have cradle-to-cradle responsibility for the products they create and sell and are responsible for designing and managing effective end-of-life systems for those products.²⁴

Taking into consideration the internationally accepted definitions and constrains, to achieve Near Zero Waste, the client will divert 90% of its solid waste from WtE facilities by the end of 2018 from a 2013 baselineⁱⁱ with near zero cost increase to residents or the Town.

ⁱⁱ 2013 baseline was established by taking the average of waste generated in years 2009 - 2013 for the Town of Mamaroneck and the Village of Larchmont.

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Methodology



Maxwell Avenue Facility, Town of Mamaroneck

Overview

The project was broken into three phases: data collection, analysis, and synthesis. The data collection phase was split across two different focus areas. The first focused on Mamaroneck and obtained information to increase the understanding of the waste stream and its management. The second research effort looked outside of Mamaroneck to identify national and international solid waste leaders, the best practices that they implement in their municipalities, and the applicable data used to create the recommendations for Mamaroneck's waste stream. Both qualitative and quantitative data were derived from scholarly articles, publicly available datasets, and first-person interviews conducted with key personnel by phone or in person.

As the data collection process was completed, the team focused on analyzing the information with specific emphasis on finding areas for waste reduction. This identified opportunities within Mamaroneck's waste stream and operating structure, as well as how other towns addressed similar waste categories and opportunities. This fed into the synthesis phase, where the team looked to create recommendations that focused on the areas with the highest potential impact within Mamaroneck's waste stream at the lowest possible cost.

Data Collection & Research

Conducting analysis on the current waste management system was important for developing recommendations for the Town. This research included developing an understanding of the following:

- Geographic boundaries of the project
- Entities included in the Town's collection system
- Waste collection system logistics
- Maxwell Avenue recycling center drop-off programs
- Mamaroneck and Westchester County waste and recycling policies
- Town communications with residents
- Commission's budget and expenditures
- Composition and tonnage of the waste stream.

Quantitative data pertaining to Mamaroneck and Larchmont's baseline waste profile and finances were obtained from resources at both the County and Commission levels. These data were combined with research, interviews, follow-up data requests to the client, and a visit to the Town to speak with Town Administrator Steve Altieri, Town Supervisor Nancy Seligson, members of the Mamaroneck Sustainability Collaborative, and several residents. This process facilitated an understanding of how the system functions on both the Town and County levels, which waste streams it does and does not capture, and potential areas for improvement.

Cost-Benefit Analysis

A simplified cost-benefit analysis was one of two tools, along with the waste reduction estimate, utilized in this project to assist decision makers in comparing and assessing recommendations.ⁱⁱⁱ For each proposed recommendation, the analysis estimates capital and management costs, as well as areas of reduced tipping fees or offsetting revenue, to determine a net cost of the project. Both costs and revenue calculations are estimated over a five-year period, based on the maximum payback length requested by the client. Each recommendation contains analysis of costs and offsetting revenues on a stand-alone basis to assess the feasibility of conducting the program individually and for facilitating prioritization among the recommendations. The costs and offsetting revenues of the full package of recommendations are also included for a comprehensive financial analysis of the full Near Zero Waste strategy.

Cost estimates are derived from costs identified in research on comparable programs and adjusted for variations in the scale of the program or changes in program features required to localize the recommendation for use in Mamaroneck. Estimates of offsetting revenue are developed through a two-stage analysis. First, an estimate of the potential waste impact to be achieved is established using methodology specific to each recommendation, as described in greater detail below. Once an impact estimate is established, the expected volume of waste to be reduced or diverted from the WtE facility is assessed for reduced tipping fee or offsetting revenue-earning potential. Reduced fees and offsetting revenue may be derived from the following sources:

1. Savings earned through reductions in tipping fees paid to the County
2. Offsetting revenue from residents' purchase of supplies associated with the recommendation (e.g., household compost bins)
3. Offsetting revenue earned by the Commission from the sale of waste to private haulers (e.g., textiles) as derived from comparable programs or local contractors known to provide the service

Waste Reduction Estimate

Waste reduction estimates were used to determine the waste reduction potential of each proposed recommendation. Each recommendation contains a waste reduction impact based on similar successful program(s) implemented in other cities and towns. Selected cities and towns chosen have similar demographics to the Town to increase the likelihood of comparability. In some cases, when more than one waste impact dataset was available, a high and low estimate is provided. The waste impact data obtained were adjusted to account for the Town's population, and an estimate of the waste reduction potential for each recommendation was calculated.

ⁱⁱⁱ Discount rates and sensitivity analysis were not applied in this cost benefit analysis. In consultation with the client, it was decided that these tools were not required due to restrictions on the size (in terms of capital) and duration of projects.

Additional detailed notes on methodology pertaining to the cost-benefit analysis, waste impact, and tipping-fee-reduction potential of each recommendation are included within the Recommendations chapter and within the Analysis Worksheet.

Interviews

The Town of Mamaroneck and Westchester County have different departments and systems working collaboratively on the waste and recycling collection and pickup processes. A moderate amount of this information is publicly available, however, it was necessary to supplement this information with greater qualitative and quantitative information collected through interviews. Interviews were conducted with personnel involved with waste management at various levels of the Town and County to gain a stronger understanding of the overall system.

External interviews were also performed to better understand the best practices in benchmarking towns and cities. With well-designed scripts and questions, both qualitative and quantitative data were gathered for analysis and benchmarking the performance of these towns as compared to that of the Town of Mamaroneck. For example, We Future Cycle provided vital information on their food waste collection system within school districts in neighboring towns, which informed the food waste recommendation for the Town of Mamaroneck. To date, the team has performed 23 external interviews and two internal interviews to inform and validate the project.^{iv}

Benchmarking

The purpose of benchmarking Mamaroneck's performance in solid waste management against other towns was to compile a database of domestic and international cities that are recognized as leaders in this field. Criteria used for selection included a city's recycling rate, financial budget, and types of waste management programs in place.^v Benchmarking the selected municipalities increased the understanding of best practices for managing solid waste and achieving high participation rates among community members. Information was collected and organized into a Microsoft Excel spreadsheet and informed the recommendation phase.

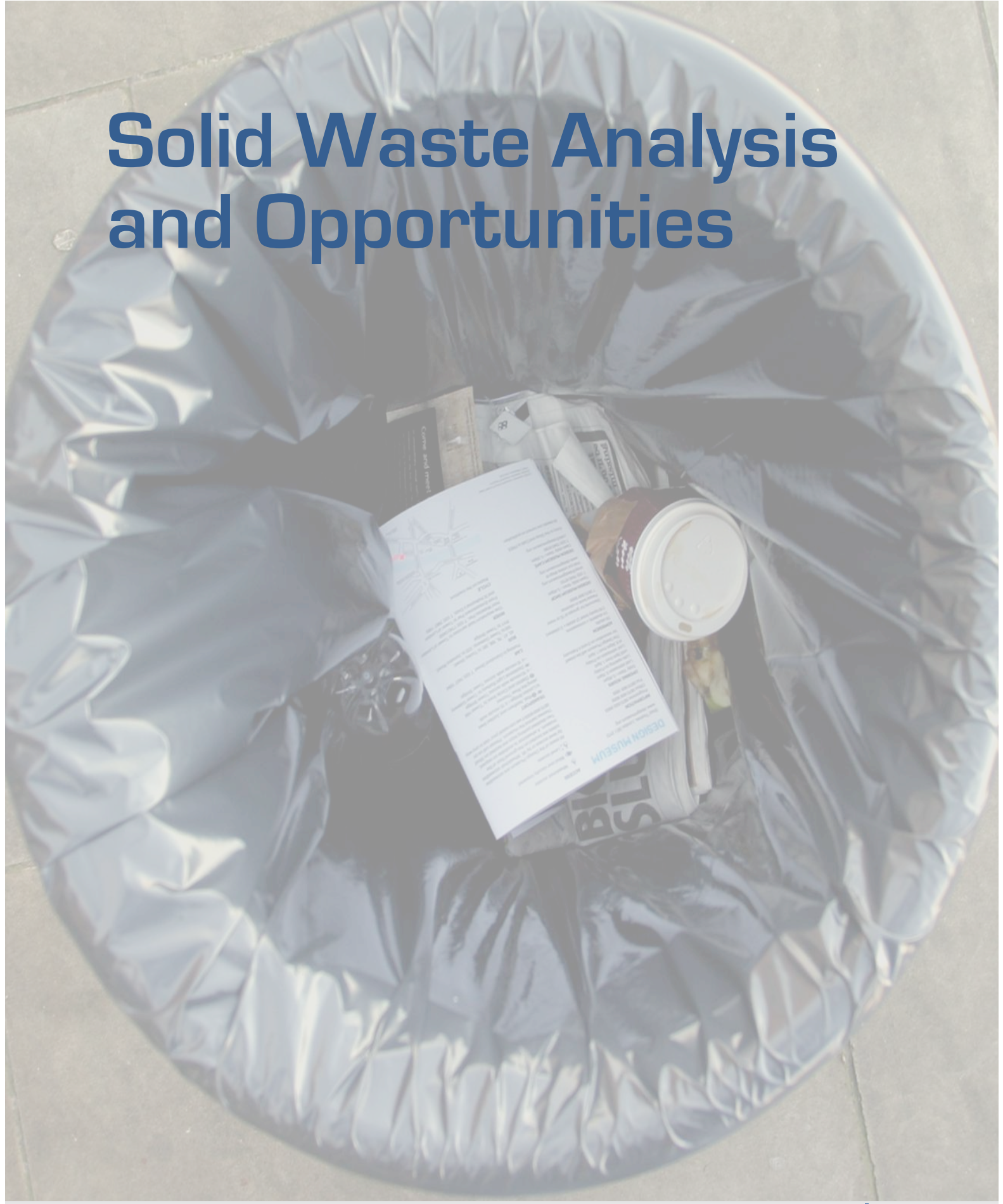
Following the benchmarking study, four towns were selected for in-depth case studies. These towns have similar demographics to those of the Town and utilize Zero Waste strategies similar to what Mamaroneck would need to implement to meet its Near Zero Waste goal. The four selected towns include Southold, New York, Natick, Massachusetts, Carrboro, North Carolina, and Capannori, Italy. They were selected to understand the best solid waste management practices regionally, nationally, and internationally. For each of these towns, comprehensive demographic information, such as population, number of housing units, type of housing units, number of businesses, per capita income, and household median income were collected and compared to those of

^{iv} See Appendix 2 for complete list

^v See Appendix 9 for complete list

Mamaroneck. Solid waste management practices for residences and businesses were also collected. The recycling practices, recycling rates, innovative initiatives for increasing participation rates, collection of yard waste, Pay-As-You-Throw (PAYT) programs, and other initiatives were collected and analyzed to inform initial recommendations to the Town.

Solid Waste Analysis and Opportunities



Introduction

It was necessary to thoroughly understand both Mamaroneck’s expenditures and waste stream in order to inform recommendations for achieving Near Zero Waste. Through data collection and analysis, it was possible to identify the categories in the waste stream that represented the highest potential impact for waste reduction and financial savings for the Town.

Commission Expenditure Analysis

The Commission’s waste budget includes waste disposal expenses associated with tipping fees paid to the County and management expenses associated with the operations of the waste system. An expenditure analysis of the Commission was important for determining potential expenditure reductions and offsetting revenues that could be derived from diverted waste streams and operational efficiencies.

Per-ton costs are derived from tipping fees paid by the Commission to the County for discarded garbage and for yard waste. The fees are \$27.09 per ton of discarded waste and \$16.32 per ton of yard waste.¹ **Figure 2** and **Figure 3** below show the total tipping fees paid over the five-year period from 2009 to 2013².

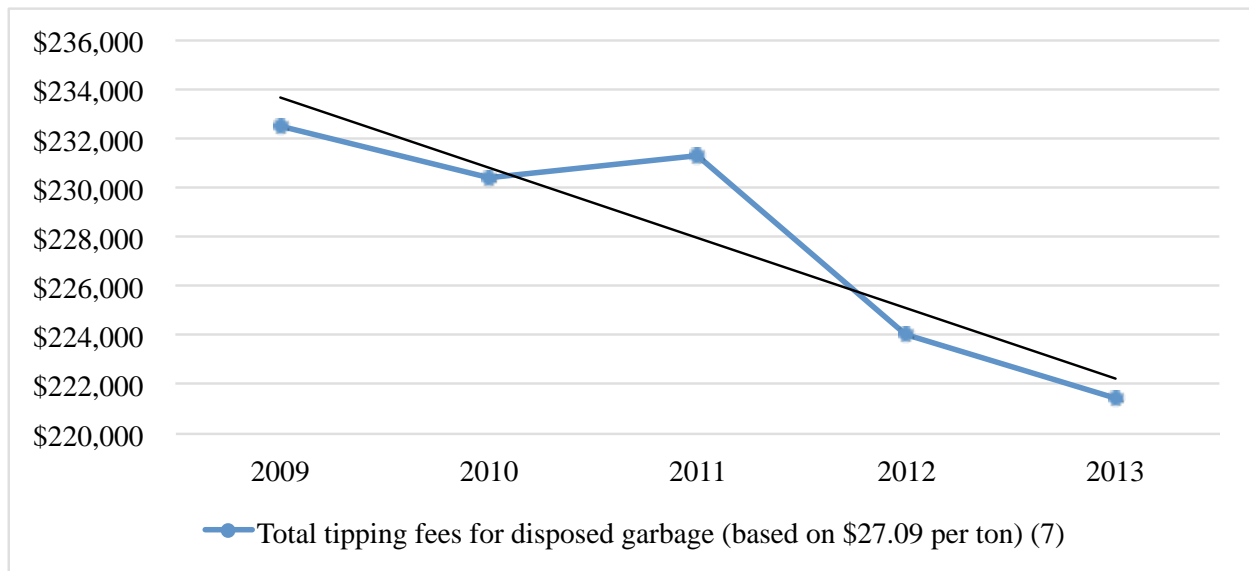


Figure 2: Discarded Garbage Tipping Fees (2009-2013)

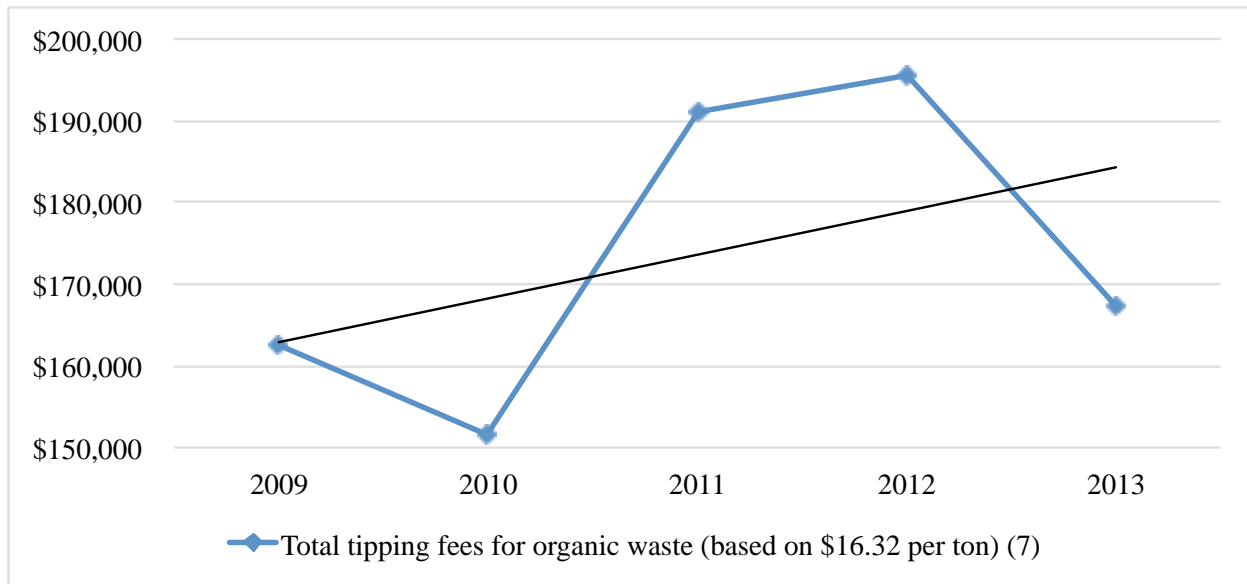


Figure 3: Yard Waste Tipping Fees (2009-2013)

The trend of decreasing tipping fees seen in **Figure 2** correlates to the general reduction in waste observed over the five-year time period. The organic yard waste shows an upward trend, which is due primarily to Hurricane Irene in 2011 and Hurricane Sandy in 2012.

Overall waste management costs are derived from the Commission’s financial report.³ This project assumes a baseline of annual expenditures totaling \$3.12 million.^{vi} Data reported by the Commission show that 82% of the Commission’s annual costs are associated with personnel, while 13% are comprised of solid waste and yard waste tipping fees.^{vii} This suggests that savings from reduced tipping fees generated by waste reduction provide a limited revenue source for waste reduction programs and recommendations. While outside the scope of this project, operational efficiencies and alternative revenue sources which could be generated through implementing the recommended programs should be further explored to maximize the potential reduction of per capita taxes.

Solid Waste Profile 2009-2013

A five-year waste profile was assembled to provide an overview of the Commission’s waste collection and management for the most recent five years and to highlight any trends or variances that may not be apparent in the constructed baseline data. It was developed based on waste volumes reported on an annual basis to the County for the Town of Mamaroneck and Village of Larchmont. **Figure 4** summarizes the waste produced for the five-year period 2009 to 2013². It is reported across

^{vi} To reduce annual variability in expense line items, the baseline expenditure breakdown takes an average of actual expenditures for 2011 and 2012, the two years for which data are available.

^{vii} Tipping fee expenditures were calculated by multiplying tipping fee rates per tons of organics and discarded waste paid to the county by the total tons of waste reported to the county. The total organic tipping fees calculated using this methodology represents a significant discrepancy from the amount reported in the Commissions financial report, however clarification of this discrepancy was not provided by the time of the publication of this report.

eight categories, with a ninth category reported for Superstorm Sandy organic waste for 2012 and 2013.

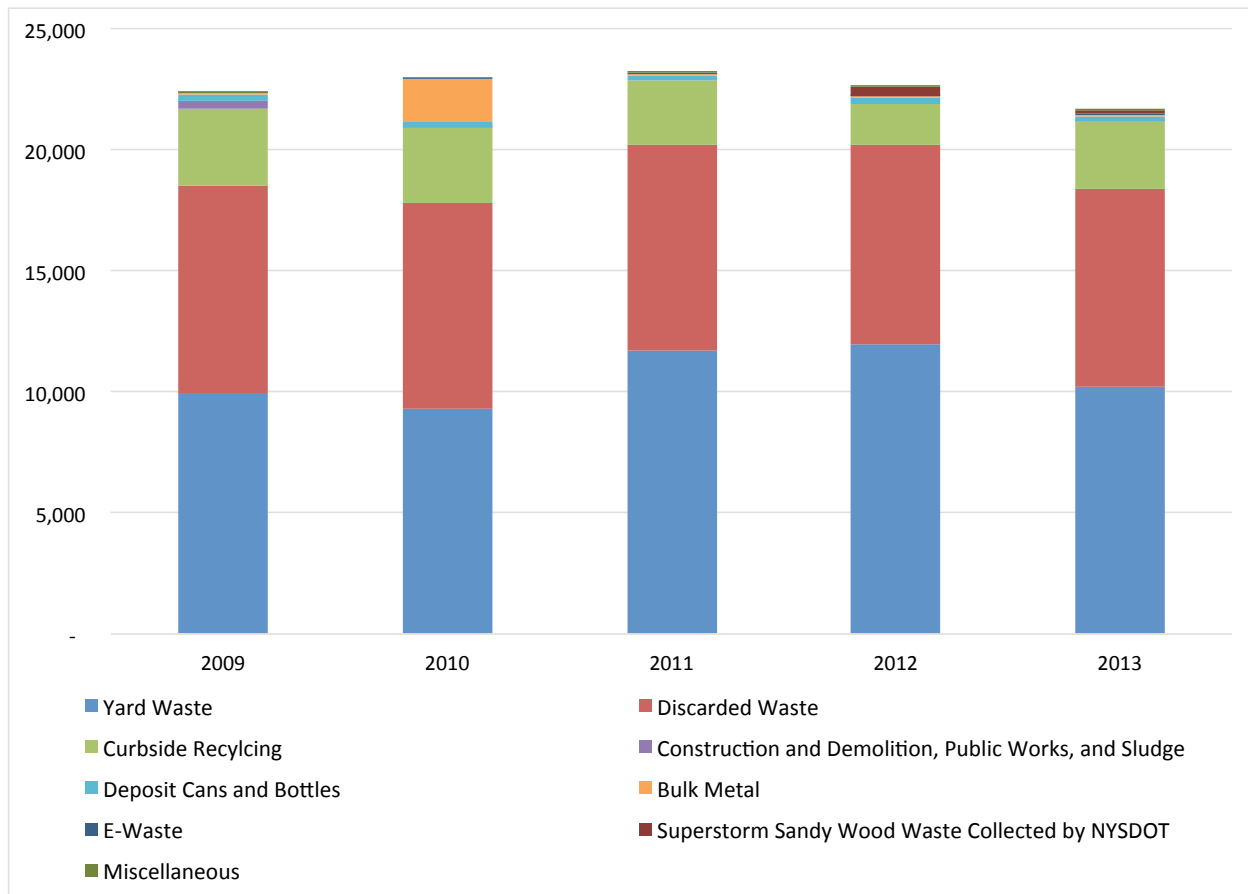


Figure 4: Total Waste by Category (in tons)

The data reported in **Figure 4** show a slight trend of diminishing overall waste volumes, with a high of 23,188 tons in 2011 and a low of 21,657 tons in 2013. Yard waste comprises the largest percentage of waste by volume in each year, followed by discarded waste.

There are two waste streams in the Town for which data are unavailable. First, the waste produced by the largest commercial entities is collected by private haulers, not by the Commission, and is therefore not included in this analysis. This results in a lower total volume of waste generated within the Town’s boundary and has unclear impacts on the diversion rate and the composition of the waste profile by category. Second, the Commission facilitates collection of furniture at its Maxwell Avenue facility, which is then picked up by a private hauler that sells or recycles the furniture. The lack of data on this category of waste results in a lower total volume of waste and an under-reporting of the percentage and volume of waste diverted from the WtE facility. Both waste streams are out of the scope of this project, however, they are recognized to be additional sources of waste within the geographical boundary of the project.

Key Waste Streams for Reduction

To determine a baseline waste profile, County-reported annual waste data for the Town between the years 2009 and 2013 were used.^{viii} The baseline annual waste is 22,583 tons or six pounds per person per day, of which 2.5 pounds is sent to the County’s WtE facility in Peekskill.² The total annual waste is broken down by volume and the percentage of total for each waste category in **Table 1**:²

Table 1: Baseline Waste by Volume and Percentage of Total Waste

Waste Category	Diverted from WtE	Waste in tons	Percent of total waste
Yard Waste	Yes	10,637	47.1%
Curbside Recycling	Yes	2,676	11.8%
Bulk Metal	Yes	404	1.8%
Deposit Cans and Bottles	Yes	221	1.0%
Superstorm Sandy Wood Waste Collected by NYSDOT	Yes	98	0.4%
Construction and Demolition, Public Works, and Sludge	Yes	94	0.4%
E-Waste	Yes	33	0.1%
Miscellaneous	Yes	5	0.02%
Subtotal Solid Waste Diverted from WtE Facility		14,168	63%
Discarded Waste	No	8,415	37%
Total Waste		22,583	100%

All waste that is not categorized as “Discarded Waste” in Table 1 is diverted from the WtE facility each year. The baseline shows that, on average, 63% of the Town’s solid waste is diverted from the WtE facility.^{ix,4} Achieving Near Zero Waste requires implementing efforts aimed at reducing, recycling, or reusing the remaining 37% of solid waste included in the “discarded waste” category.

Developing targeted recommendations requires an estimate of the composition of the discarded waste segment of the Town’s waste profile. In the absence of a detailed waste audit, several waste audits that were conducted at both the local and national levels were assessed. The project selected the EPA’s national waste audit to develop an estimate of the composition of the Town’s discarded

^{viii} To minimize the effects of outlying results from a particular year, we calculated a five-year average to use as the baseline.

^{ix} When Yard Waste and Construction and Demolition, Public Works, and Sludge are removed, the recycling rate is 26%. Programs such as Westchester County’s “Love ‘Em And Leave ‘Em” encourage residents to eliminate yard waste from the solid waste stream by shredding the waste and leaving it on the lawn. This program would result in cost savings on organic tipping fees, but would not impact the Town’s recycling rate.

waste.^x **Table 2** summarizes the estimated composition of the Town’s discarded waste stream based on the EPA categories.²

Table 2: Estimated Composition of Town’s Discarded Waste Based on EPA Data

Waste Category	Waste in tons	Percent of total waste
Food Waste	1,784	8%
Plastics	1,484	7%
Paper and Paperboard	1,282	6%
Bulk Metal	747	3%
Yard Waste	734	3%
Wood	687	3%
Textiles	585	3%
Glass	428	2%
Rubber and Leather	316	1%
Miscellaneous Inorganic Waste	198	1%
Other	171	1%
Total	8,415	37%

Waste streams contributing to the discarded waste category inform the highest impact areas that the recommendations look to address. Food waste and textiles respectively constitute an estimated 8% and 3% of the Town’s total waste. Both waste streams are currently sent to the WtE facility and represent the two largest waste categories without initiatives at the municipal level to reduce the volumes of these waste streams being discarded. Initiatives to reduce food and textile waste in the waste stream are thus recommended as effective methods for achieving the Near Zero Waste target.

Although the Town has existing recycling programs for paper, cardboard, glass, metals, and plastics, 100% participation rates are not typically achieved. An estimated 18% of the Town’s total waste is comprised of these waste categories that can be recycled but are still being discarded. This is arguably the lowest hanging fruit for the Town to achieve Near Zero Waste most efficiently. Recommendations that drive up participation rates and encourage behavior change can reduce these categories from the discarded waste stream.

^x The EPA’s national waste audit provides data for 2010, 2011, and 2012. It is unique because it breaks down the composition of discarded waste as Total Waste minus Recovered Waste, thereby providing the best estimate for the composition of the Town’s discarded waste category. The EPA waste audit breaks down discarded waste into eleven categories. The project extrapolated the EPA’s composition of discarded waste onto the Town’s discarded waste volume, to determine an estimate for the composition of the town’s discarded waste.

References:

¹ Petronella, Marianne. Personal Interview. October 20, 2014.

² Authors' Calculations. *Waste Data and Analysis*. Analysis Worksheet.

³ Altieri, Stephen V. Larchmont Mamaroneck Joint Garbage Disposal Commission. *Budget 2013 Financial Report*. January 18, 2014.

⁴ Westchester County. *Love 'Em And Leave 'Em. Home Page*. Web. Available at: <http://www.leleny.org>. [Accessed on November 28, 2014].

Recommendations for Near Zero Waste Strategy



Overview

Many policy and program recommendations were considered to achieve Near Zero Waste, however, not all could be implemented due to logistical or political restrictions specific to Mamaroneck. For example, a single-stream recycling program, which would allow residents to commingle all of their recyclable materials in a single bin, was initially looked at but ultimately abandoned due to restrictions in the Town's current recycling contract with the County.^{xi} Switching to a private hauling system was also considered but was not recommended due to greater overall costs with insignificant waste reduction returns.^{xiii}

The finalized recommendations are centered on two waste reduction strategies; the first strategy addresses waste materials that can be recycled but are not currently included in the Commission's collection programs, and the second strategy focuses on improving participation rates in existing recycling programs through financial incentives and communications strategies. Prior to undertaking efforts associated with these recommendations, this report suggests hiring a full-time staff member to work with the Commission to conduct a comprehensive municipal waste audit for the Town in order to verify assumptions used to establish a baseline of the Town's discarded waste. This staff member will also be responsible for managing the implementation of all the recommendations put forth in the Near Zero Waste strategy.

Table 3 provides a summary of all recommendations and the population segments that are targeted. Each recommendation includes details of the maximum waste diversion potential, total costs, total offsetting revenue, and net cost/revenue expected within five years of implementation.

^{xi} See Appendix 7 for further details

^{xiii} See Appendix 3 for further details

Table 3: Recommendations Summary Table

Recommendation	Single-Family / Multi-Family / Non-Residential	Maximum Waste Diversion Potential	Total 5-Year cost	Total 5-Year Offsetting Revenue	Net Cost/Revenue
Waste Audit					
Waste Audit	Single-Family / Multi-Family / Non-Residential	0%	\$ -	\$ -	\$ -
Textiles					
Textile Recycling Collection Bins	Single and Multi-Family	0.82%	\$ -	\$ 147,125	\$ 147,125
Residential Carpet Recycling	Single and Multi-Family	0.10%	\$ (6,661)	\$ 2,836	\$ (3,826)
Food Waste					
Backyard Compost	Single-Family	0.03%	\$ (3,154)	\$ 3,742	\$ 589
Drop Off Based Food Compost (Private Hauler)	Single and Multi-Family	1.02%	\$ (131,472)	\$ 18,756	\$ (112,716)
School Compost Pick Up	Non-Residential	0.52%	\$ (214,500)	\$ 15,848	\$ (198,652)
Increase Participation In Existing Programs					
"Oops" Stickers	Single and Multi-Family and Non-Residential	2.18%	\$ -	\$ 40,009	\$ 40,009
Tote Bags And Bins In Multi-Family Homes (Low Estimate)	Multi-Family	0.15%	\$ (7,920)	\$ 4,439	\$ (3,481)
Tote Bags And Bins In Multi-Family Homes (High Estimate)	Multi-Family	0.41%	\$ (7,920)	\$ 12,684	\$ 4,764
Pay-As-You-Throw (PAYT)					
Pay-As-You-Throw Multi Tiered Bag Program (Low Estimate)	Single and Multi-Family and Non-Residential	5.22%	\$ (581,492)	\$ 4,883,007	\$ 4,301,515
Pay-As-You-Throw Multi Tiered Bag Program (High Estimate)	Single and Multi-Family and Non-Residential	6.33%	\$ (581,492)	\$ 4,903,524	\$ 4,322,032
Implementation Costs					
Project Staffing Requirement		0%	\$ (290,120)	\$ -	\$ (290,120)
Totals					
Low Estimate Total		10.03%	\$(1,235,319)	\$ 5,115,762	\$ 3,880,443
High Estimate Total		11.42%	\$(1,235,319)	\$ 5,144,523	\$ 3,909,205

Recommendation: Conduct a Municipal Waste Audit

An effective solid waste management strategy starts by understanding the existing waste stream. A waste audit is the most widely used tool for this purpose.¹ It is a comprehensive analysis of the diverse types and sources of waste that are collected as part of the different waste streams.² A waste characterization study is the analysis of samples of a particular waste stream or waste collected at a particular point in time. It can identify both the quality and quantity of waste materials generated. Waste characteristics studied include sources, composition, weight, volume, and final destinations.³ It is recommended that the Town conduct a waste characterization study in advance of a more comprehensive municipal waste audit to be completed in the future.

Both the EPA and New York State's Department of Environmental Conservation estimate that in 2012, 53% of waste discarded at both national and state levels was recyclable.^{4,5} While this project has developed an estimate of the composition of the Town's discarded waste based on EPA national data, a waste audit in Mamaroneck could more accurately identify the four or five most critical waste streams for the Town to address. It would make the report's recommendations and their benefits much more relevant to the Commission's needs.

A waste audit may help Mamaroneck discover potential additional categories of materials suitable for recycling, which are currently overlooked, and can be an effective training tool for sanitation personnel. Besides immediate benefits, a waste audit can set a baseline for measuring progress of Near Zero Waste efforts and identifying which phases may need extra attention. It will allow the Town to assess how well residents and businesses are complying with existing recycling regulations and where more education is needed.⁶

This audit would be intended for all waste managed by the Commission at both residential and non-residential properties. The Town is recommended to conduct the waste audit in multiple phases beginning with a few entities at a time selected from the following categories:

- Office Buildings
- Restaurants
- Single-Family Homes
- Multi-Family Homes
- Parks
- Retailers
- Schools
- Government Buildings

Three options are available for the Commission to begin implementation of the waste audit. The first is through either federal or state government assistance. The EPA's Waste Wise program and the

New York State Department of Environmental Conservation both offer municipal waste audit implementation services at no additional cost to interested towns. However, they require a lengthy application period to be awarded eligibility.⁷ Another option is to solicit a private vendor, which would be more expensive for the Town but could provide faster results. Consulting rates start at \$50,000 for a visual waste audit and cost anywhere between \$200,000 and \$400,000 for a comprehensive waste audit.⁷ The third and most viable option is for the Commission to conduct its municipal waste audit independently of federal, state, or private support in order to avoid the time and financial commitments previously discussed. It is recommended to start with a waste characterization study in advance of this audit because it will require less time and resources and will still provide a deeper understanding of the Town's waste streams. Once complete, the Commission will be equipped to begin the municipal waste audit with a better understanding of the following aspects of the Town's generated solid waste:

- What are the waste disposal patterns followed by residents, businesses, offices, schools, and other entities
- How much of the waste is properly or not properly disposed
- What percentage of improperly disposed waste could be recycled

The long-term plan to address the key findings and the process involved in ensuring the implementation of the solutions to address those findings will become part of the more comprehensive, long-term waste audit. The case study for New Paltz, New York, found in Appendix 6, provides more information on how conducting a waste characterization study better prepared them for their municipal waste audit. This showed that the primary costs associated with conducting a municipal waste audit were in labor costs and the time required in conducting the audit. Therefore, it is recommended that the Commission's new staff member will manage both the waste characterization study and the waste audit, in addition to the recommendations discussed later in this section. Some of the responsibilities as part of the staff member role will include volunteer training and program design. The Implementation section will further discuss the responsibilities of this individual and the timeline for each recommendation.

Recommendation: Textile Diversion

Textiles, which refer to any material made from fibers, thread, or yarn, represent the second-largest component of the Town’s total discarded solid waste for which there is not an existing recycling program in place. It constitutes an estimated 585 tons, or 3%, of discarded waste per year. Therefore, it is recommended that the Town implement two programs to enable recycling of household textiles, including clothing, bedding, and carpeting. **Table 4** summarizes the waste diversion potential, costs, and offsetting revenue associated with these recommendations.

Recommendation 1: Textile Collection – Wearable Collections^{xiii}

Table 4: Textiles – Waste diversion and Financial Impact¹⁴

Recommendation	Single-Family / Multi-Family / Non-Residential	Maximum Waste Diversion Potential	Total 5-Year Cost	Total 5-Year Offsetting Revenue	Net Cost / Revenue
Textiles					
Textile Recycling Collection Bins	Single-Family and Multi-Family	0.82%	\$0	\$147,125	\$147,125
Residential Carpet Recycling	Single-Family and Multi-Family	0.10%	\$(6,661)	\$2,836	\$(3,826)

Wearable Collections, a New York City-based firm devoted to keeping textiles and clothing articles out of landfills, manages indoor and outdoor collection bins throughout New York City in residential buildings, schools, and offices. It has been recycling textile in the New York Metropolitan Area since 2004.⁸ Half of its collection is sold to the second-hand clothing market, while the rest is repurposed as rags for the automotive industry and as insulation.⁹ This is beneficial because it extends the life of usable products and ensures proper disposal of clothing and textiles past their useful life. Wearable Collections is currently one of the few textile-recycling companies in close proximity to Mamaroneck that offers profit sharing, hence the waste reduction potential is assumed to be similar to other collection bins.

^{xiii} The amount of textiles discarded per person was obtained from an interview with Adam Baruchowitz of Wearable Collections. Since the collection bins are provided for free, there are no costs associated with this program. The revenue generated is due to the reduced tipping fee from the estimated volume of waste reduced and the estimated value of the sale of the textiles. The waste reduction impact after five years is 0.82%.



Figure 5: Wearable Collections Box (left) and Collection Booth at Greenmarket (right)^{10,11}

Placing Wearable Collections bins throughout the Town could successfully divert the Town’s textile waste in a responsible and cost-effective manner. The program is estimated to achieve its full participation rate of 185 tons per year for the Town beginning in its second year, resulting approximately \$32,000 in reduced tipping fees and offsetting revenue from the sale of the textiles.^{14,12} Although it does not generate any upfront or recurring costs to the Town, an outreach and education program for residents and non-residential entities would have to be in place for maximum impact and would have a moderate cost associated with it.

Wearable Collections could initially place one of their textile collection bins at the Maxwell Avenue recycling facility. A six-month pilot program could help gauge the potential participation rate within the Mamaroneck market and the quantity of textiles available to recycle. Further pilot programs could be implemented to test for different bin locations and participation rates among different community buildings, such as schools, churches, or office buildings.

Adam Baruchowitz, the Chief Executive Officer of Wearable Collections estimates that the Town of Mamaroneck could receive between \$0.05 and \$0.10 per pound of textile collected.¹³ The variability in the incentive is based on time of year, market influences, and volume. There is neither an upfront cost nor a recurring cost to the Town, which means the payback is immediate. Based on data analysis, the estimated reduced tipping fees realized by the Town will be \$147,125 within a five-year period and the estimated waste diversion could be 0.82% annually.¹⁴

The stakeholders involved in this recommendation are Town residents, schools, churches, and voluntary community groups. The Town will have to collaborate with Wearable Collections to educate and raise awareness of this textile recycling opportunity among all of these stakeholders. Wearable Collections can assist in advertising the program among students, teachers, churchgoers, and community organizers. Volunteer community groups can help with curbside pickup of textile

materials when needed and transport them to the collection bins. This could provide additional services at no additional cost to the Town.

Recommendation 2: Carpet Collection – CarpetCycle^{xiv}

CarpetCycle manages carpet collection trailers and provides door-to-door carpet and tile collection services to residential and non-residential entities in New York City and several municipalities in New Jersey. It has been safely diverting post-consumer carpet from landfills since its inception in 1999.¹⁵ After these carpets are collected and transported to CarpetCycle’s facility, they are sorted and processed as new yarns for clothing, textiles, auto parts, and even new construction materials.¹⁶ CarpetCycle is also the closest carpet recycling company to the Town within the Carpet America Recovery Effort (CARE) national network. This program could divert an estimated 0.1% or 23 tons of disposed textiles that currently go to the WtE facility in Peekskill.¹⁴

The program would be at full participating potential when it reaches an estimate of two pounds per person per year, which is predicted to be achieved during the second year of the program.¹⁷ Although CarpetCycle charges a flat fee of \$350 for the service of taking a full trailer and replacing it with an empty trailer, this cost could be offset through a reduced tipping fee from the carpets no longer being in the disposed waste stream. It is recommended that a CarpetCycle trailer of 48 feet in length be placed at the Maxwell Avenue recycling facility. With education and outreach targeting local construction and demolition companies, a one-year pilot program could determine the potential market for participating households and the quantity of carpeting waste that they generate. Within the pilot program, the Town could also gather feedback through an annual survey from participating companies and individuals as to the most convenient location for the trailer to be placed. An introductory program design meeting is required within the first month. The only change required to the current waste collection system would be to dedicate a specific location within the Maxwell Avenue recycling facility for the trailer itself.

CarpetCycle only accepts residential carpets in the trailer and charges a flat rate of \$350 per trailer turnover. Residents can drop off their household carpets in the trailer, and non-residential entities can arrange for pickup at their own expense based on the size of carpet and services required.¹⁸ Based on CARE's 2013 annual survey, 2.52 pounds of carpet waste per capita is collected for recycling purposes.¹⁹ At this rate, carpet recycling has the potential to divert an estimated 23 tons of annual solid waste for the Town at an estimated five-year net cost of \$3,826.^{14, 20}

^{xiv} The amount of textiles discarded per person was obtained from an interview with Sean Ragieli of CarpetCycle. The cost associated with this program stems from the trailers’ turnover fee. The revenue generated is due to the reduced tipping fee from the estimated volume of waste diverted. The waste reduction impact over five years is 0.1%.

Recommendation: Food Waste Diversion

The EPA estimates that in the U.S., food waste represents 21% of the total waste that ends up in municipal landfills and is the largest component of the solid waste stream.²¹ A food waste diversion program could bring Mamaroneck closer to its Near Zero Waste goal by removing food from the waste stream that is sent to the WtE facility. Food waste is estimated to account for 8% or 1,784 tons of the Town's annual waste stream. Without recycling programs targeting food waste, this entire waste stream is currently being sent to the WtE facility at an estimated cost to the Town of \$48,058 per year.^{14, 22}

For the Town of Mamaroneck, a food waste diversion program will face logistical and operational hurdles. Westchester County does not allow food waste to be combined with yard waste, thus the Town must decide if it will implement a composting program using its own resources and personnel, or contract out its food waste collection. If the Town chooses to implement a composting program using its own resources and personnel, this would require finding a composting facility that accepts food waste and is within a reasonable travel distance to the Town, otherwise the expense and impact of hauling would exceed the benefits of collection. It would also require either retrofitting existing equipment or purchasing a new truck. Alternatively, if it is the latter, the number of commercial waste haulers in the County who accept food waste is currently extremely limited, thereby restricting the Town's contractor options.

Despite these limitations, Mamaroneck has already begun making efforts to address the food waste generated in the Town. The Mamaroneck School Superintendent has applied for a grant for the purchase and installation of a Rocket[®] Composter at Hommocks Middle School to compost the school's food waste. This project could serve as an educational tool for the students and their parents, faculty, and staff about food waste and its value as a resource to produce a valuable by-product. Neither of the two Rocket[®] composters proposed for the project have the capacity to accept the food waste generated by the five other schools in the Town, nor the food waste generated by the Town itself, yet it could still serve as a jumping off point for future Town food waste collection programs.²³

Additionally, other food waste programs are starting in Westchester County. The Commissioner of the Department of Public Works in White Plains, Bud Nicoletti, is planning to start the collection of food waste from two select grocery stores in July 2015, using existing equipment retrofit for this collection. When the program is in place and running smoothly, they hope to expand the program to also collect food waste generated by the schools in White Plains.²⁴ This program will hopefully be an example for other towns in Westchester County, including Mamaroneck, to follow.

For the purposes of this project, data were collected for different food waste collection programs and analyzed for waste impact, cost, and feasibility. After evaluating the costs of the various programs and the waste reduction impacts, it was decided to recommend three programs: residential backyard

composting, drop-off locations, and school food waste collection. **Table 5** summarizes the waste diversion potential, costs, and offsetting revenue associated with these recommendations.

Table 5: Food Waste Diversion and Financial Impact¹⁴

Recommendation	Single-Family / Multi-Family / Non-Residential	Maximum Waste Diversion Potential	Total 5-Year Cost	Total 5-Year Offsetting Revenue	Net Cost / Revenue
Food Waste					
Backyard Compost	Single-Family	0.03%	\$(3,154)	\$3,742	\$589
Drop-Off Food Compost (Private Hauler)	Single-Family and Multi-Family	1.02%	\$(131,472)	\$18,756	\$(112,716)
School Compost Pickup	Non-Residential	0.52%	\$(214,500)	\$15,848	\$(198,652)

Two programs, curbside collection and in-vessel composting, were researched and determined to be poor options for the Town of Mamaroneck at this time due to high upfront costs. The curbside collection program for residential customers is appealing because it provides high waste-reduction potential, but the cost to the Town is approximately \$2.8 million dollars over five years¹⁴. An in-vessel composting system could allow Mamaroneck to compost both food waste and yard waste and could provide it with compost materials that it could use on its grounds, but for high reduction potential, the upfront costs are prohibitively expensive.²⁵ Detailed descriptions of these two programs, as well as a table indicating the various food waste collection programs researched for the Town, are included in Appendix 8.

Recommendation 1 – Backyard Composting

A backyard composting program for residents could divert food waste from Mamaroneck’s waste stream with no need for collection or transportation of the waste for disposal. This is a complementary program to the other food waste recommendations with an estimated waste impact of 0.03% and estimated net revenue of \$589.¹⁴ Residents can include yard waste in their composters and may at times use the drop-off program if they generate large amounts of food waste. Backyard composting creates soil amendments, a usable by-product for residents to use in their yards. This will help the soil retain moisture, reduce stormwater runoff, and reduce the need for chemical fertilizers and pesticides.²⁶ The composting can take place in backyards and may be shared by more than one household if that solution works for a block or neighborhood.

To implement this voluntary program and to encourage participation, the Town can purchase compost bins in bulk to sell to residents. It is recommended that the bins be sold at a break-even price as participation rate and success of the program can be improved by making the purchase of equipment easy and convenient for residents.²⁷ A kickoff event can be held to promote the program and encourage participation. Following the kickoff event, a system can be established for residents to purchase bins at locations including Saturdays at the Maxwell Avenue recycling center and at the local farmers market.

Education programs will increase the participation rate among residents in the backyard composting program.²⁹ These can be conducted through educational meetings, workshops, a question and answer booth at the farmers market, and a compost information page on the Town’s website.

Case Study: Montclair, New Jersey

Montclair, New Jersey, started a backyard compost program in 2002. They have approximately 38,000 residents, with approximately 8,000 single and two-family residences. The city purchased the “Earth Machine” compost bins in bulk to sell to residents at the break-even price. They have sold 1,000 units in the last 10 years. The Town’s website has a page devoted to this program and residents can call the “Rotline” with questions. They also have an annual “Compost GiveBack” event when residents can pick up free compost for their use. This event is also used to answer questions, promote the program, and sell compost bins.²⁸

Recommendation 2 - Residential Food Waste Drop-Off Collection

To provide another option for residents to remove their food waste from the solid waste stream, it is recommended that the Town also implement a compost drop-off program. The program has an estimated waste impact of 1.02% and an estimate net cost of \$112,716.¹⁴ The planning phase of this recommendation is relatively straightforward because a drop-off program will not require substantial upfront capital costs.

The collection program can provide a central location within the Town where residents drop off their food waste. If the program experiences a high level of usage by residents, it could then add additional drop-off collection locations throughout the Town. Cambridge, MA instituted a food waste drop-off program in 2008 and added locations as the participation rate increased. They now have four drop-off locations.³⁰ The advantage to decentralizing the program is that it could make it more convenient and easy for residents to drop off their food waste. The farmer's market, train station, and Maxwell Avenue recycling facility are feasible options for bin placement as these areas currently receive a consistent level of foot traffic. This program could benefit residents of both single-family and multi-family homes, giving them the voluntary opportunity to compost and remove organics from their garbage. Offsetting revenue from the program would be in the form of reduced tipping fees.

Drop-off locations should be open for a designated number of hours throughout the week and locked and sealed each night to deter any unwanted pests or animals. Alternatively, if the Town prefers to operate drop-off locations only during weekend hours, the program could still have the potential to collect a sizable amount of

Case Study: Brattleboro, Vermont

The Windham County Waste Management District (District) provides waste and sanitation services to Brattleboro, Vermont. In 2009, the District implemented a food waste drop-off pilot program known as Project COW (Composting Organic Waste) to measure resident demand for a longer-term composting program. Under Project COW, Brattleboro residents were able to bring “food scraps, low grade paper, milk cartons, and shellfish [to Windham’s Waste Management Facility] during regular business hours” free of charge. Funding for the program came from a U.S. Department of Agriculture grant that covered program costs.³⁹ Within three years, Brattleboro’s food waste program had expanded to include a curbside organics collection option.

residents' food waste. As observed in Boston, during its three-month food waste collection pilot in 2012, the City operated three drop-off locations open on the weekends for only four hours at a time. Despite the limited hours of operation, more than 6,000 pounds of food waste were collected over the three-month period.^{31,32}

Once residents bring their food scraps to the drop-off bins, it is recommended that the Town use a private hauler to transfer the food waste off-site to a private composting facility.^{xv} The costs associated with this option will depend on the hauler selected as well as the details of the contract terms. Based on previous case studies, the expense for a private hauler is estimated to cost the Town \$13,054 per year when the program achieves maximum participation and therefore maximum waste.³³



Figure 6: Drop off location at Union Square Farmers Market, NY³⁴

To lower operational costs from the drop-off program, it is suggested that Town volunteers work at the drop-off locations instead of Town personnel. Volunteers can complete a training session on how to monitor the incoming food waste as well as answer general questions residents may have about program specifics. Content covered during training sessions can be designed and compiled by the Recycling Coordinator, and later implemented as in-person classes or online workshops.

The challenge of a drop-off program is that it is voluntary, making it important to promote cooperation and participation among residents. As an incentive to encourage participation among residents, it is recommended that the Town provide home kitchen compost bins to residents free of charge. Kitchen compost bins simplify the process of at-home food waste disposal as they are designed to be dishwasher-safe, fit easily under sinks or on kitchen countertops, and can control odors.³⁵ The average retail price of home kitchen compost bins is estimated at \$25, which translates to a total cost of \$92,000 to the Town to purchase bins for all residents.^{14,36,37}

^{xv} See Appendix 8 for a discussion of in-vessel composting systems.

Food waste drop-off is a viable option for Mamaroneck and the Town could learn from the success stories of other cities like Boston, Massachusetts, Brattleboro, Vermont, and Northfield, Massachusetts, which have all implemented food waste drop-off programs. Based on an estimated 20% participation rate among residents obtained from analysis of the case studies with this program, the total revenues from the drop-off program over five years are estimated to be \$18,756, however this value could increase if the Town decides to charge a fee for the kitchen compost bin.^{14,38}

Recommendation 3 – Food Waste Collection in Schools

A school with 600 children generates, on average, 150 pounds of food waste per day.⁴³ The Commission currently manages solid waste for four schools in Mamaroneck and Larchmont. To have the greatest reduction impact on this waste stream, it is recommended that the Town work with a consultant, We Future Cycle, who specializes in setting up food waste and recyclables collection programs specifically for schools. This program would need the approval of the School Supervisor.⁴⁴ If implemented in the Town's six schools, it is estimated to have a waste impact of 0.52% at a net cost of \$198,652.¹⁴

We Future Cycle, a private firm that specializes in school waste management programs, has implemented food waste and recycling programs in schools throughout Westchester County including in New Rochelle, Scarsdale, Chappaqua, and Katonah.⁴⁵ Hastings School District recently instituted the We Future Cycle recycling and food waste programs in all three of its schools. The decrease in discarded waste exceeded the reduction estimates that were projected before the program started.⁴⁶ The program's goal is to reduce school waste output by 90-95% through enhanced waste separation. The waste category breakdown within the schools is approximately food waste at 60%, co-mingled recycling at 25%, liquids at 10%, and non-recyclables at 5%.⁴⁷

The We Future Cycle program uses a private waste hauling company, Suburban Carting, who collects food waste and recyclable materials once a week.⁴⁸ The Commission could continue to pick up non-recyclable

Case Study: Hastings-on-Hudson, New York

Hastings-on-Hudson, New York, implemented the We Future Cycle recycling program in 2014 to provide source separation of recyclable materials and food waste. The middle and high schools are located in the same building on Farragut Avenue. Before the start of the program, 800 total students produced approximately 17 bags of garbage per day. With the recycling program in place, there are now four bags of food waste, one bag of commingled recycling, and one small bag of discarded waste.⁵⁰

materials from the schools. This collection may be less frequent than the current pickup schedule because of the reduced quantity of garbage resulting from the increased removal of food, recyclables, and liquids from the waste stream. In Hastings, the number of plastic bags was reduced from 200 to only 10 bags per day per building.⁴⁹

There are an estimated 5,200 students in the Mamaroneck school system. For a 180-day school year, this amounts to approximately 117 tons of food waste per year.⁵¹ The costs associated with a program to reduce this waste include a consulting fee charged by We Future Cycle and the annual hauling and recycling fees. Cost savings come from reduced hauling fees, estimated at \$3,170 per year.¹⁴ The five-year net cost would be approximately \$198,652.^{14, 52} Benefits include improved sanitation areas⁵³ in the schools, reduced waste sent to WtE, and increased bragging rights for the Town and residents. The program could also be a learning tool for the schools to use in the curriculum for math, science, social studies, and writing.



Figure 7: Source separation in a school cafeteria⁵⁴

Education about the program will be critical and is a key component of the We Future Cycle approach and for overall success of the program. They engage and train students, faculty, and staff about each new program's ease of implementation and benefits. Included in a typical We Future Cycle maintenance contract is planning for special events to ensure that all food and recyclables are captured at sporting events, assemblies, special events, etc.⁵⁵ Involving parents, possibly through PTA groups, could help to expand the recommendation's waste reduction impact beyond schools to households as well.

Recommendation: Improving Existing Recycling Programs

Nearly half of Mamaroneck’s discarded solid waste that is currently sent to the WtE facility is comprised of recyclable materials for which there are already municipal recycling programs in place (as shown in Table 2). These materials include plastics, paper, glass, and metal and constitute 18% of the Town’s discarded solid waste stream. Improving the recycling of these waste categories is important for the Town to reach its goal of Near Zero Waste. This is underpinned by a communication strategy that includes a focus on strong education and outreach to reduce the total percentage of recyclable materials that are discarded.⁵⁶ The strategies and their applicability to various residential and non-residential entities are briefly outlined in **Table 6**.

Table 6: Applicability of recommendations to residential and non-residential entities in the Town

Recommendation and Applicability	Single-Family	Multi-Family	Non-Residential
Building a recycling culture in Multi-Family Homes with the use of totes and small bins		✓	
Enforcing “Oops” Stickers to create awareness regarding sorting of recyclables	✓	✓	✓
Student involvement and recycling in schools	✓	✓	✓

Improving existing programs to increase recycling while reducing levels of contamination and encouraging source separation in multi-family homes could pose a challenge but can be overcome by implementing Recommendation 1, detailed below. In an effort to increase recycling rates within multi-family homes, the Town, in partnership with building managers, must develop a uniform brand and message communicating that recycling is easy and helps the community to achieve its Near Zero Waste target. This could be done by distributing reusable tote bags and small bins for in-unit storage such as under the sink or in a hall closet for ease of transport of recyclables to the communal recycling area. This recommendation was chosen because of its easy implementation timeline and cost effectiveness.

Recommendation 2 centers around enforcing “Oops” stickers to educate residents on why source separation is key in ensuring that contamination does not occur. The County already has the stickers in place that are being used by a few private haulers in other towns within the County, and it is only beneficial for the Town to take advantage of this practice, as well. Monitoring and measuring the success of the program is relatively easy and can be done by looking at the number of stickers utilized. This recommendation is applicable to both residential and non-residential entities and can therefore have a huge impact on increasing recycling rates for the Town.

Because children have fewer negative environmental habits to forget and will have more time in the future to impact the environment, they represent a key population for environmental education.⁵⁷ The last recommendation is to involve schools and students in encouraging recycling practices and thus having a positive effect on behavior modification among students. **Table 7** summarizes the waste diversion potential, costs, and offsetting revenue associated with these recommendations.

Table 7: Improving Existing Programs - Waste Diversion and Financial Impact¹⁴

Recommendation	Single Family / Multi-Family / Non Residential	Maximum Waste Diversion Potential	Total 5-Year Cost	Total 5-Year Offsetting Revenue	Net Cost / Revenue
Increase Participation in Existing Programs					
“Oops” Stickers	Single-Family, Multi-Family, and Non Residential	2.18%	\$0	\$40,009	\$40,009
Tote Bags and Bins in Multi-Family Homes (Low Estimate)	Multi-Family	0.15%	\$(7,920)	\$4,439	\$(3,481)
Tote Bags and Bins in Multi-Family Homes (High Estimate)	Multi-Family	0.41%	\$(7,920)	\$12,684	\$4,764

Recommendation 1: Building a Recycling Culture in Multi-Family Homes^{xvi}

According to the EPA, multi-family homes in the U.S. had an average recycling rate of 14.6% in 2001, which was less than half the 29.7% rate achieved in single-family homes.⁵⁸ With significant room for improvement in recycling rates among multi-family homes, in comparison to its existing infrastructure, it is recommended for the Town to implement the following recommendation.

Recommendation 1 will center on providing all multi-family homes and their residents with small recycling bins and tote bags. These will be distributed to each unit within each building. The tote bags and recycling bins are intended to help residents store, collect, sort, and transport their recyclables, ensuring a near perfect infrastructure for recycling amongst the homes in place. The tote bags could be used for storing and transporting paper and grease-free cardboard while the small bins can hold commingled recyclables of plastic, glass, and metal. Additionally, the tote bags may also be used for transporting of groceries, thus avoiding plastic and paper bags, as was done in Culver City, California, and was deemed a huge success. Residents of Culver City were further encouraged to use the tote bags when empty for transporting goods, such as groceries, so as to not soil the bags and also to spread awareness among other grocery shoppers and residents.⁵⁹

Case Study: Culver City, California

Culver City, California, succeeded in making recycling a viable social norm in the community, creating a buzz and leaving a huge impact on residents in participating multi-family houses. Residents were provided with mini-bins and tote bags to make collecting and carrying recyclables to the central bin more convenient. This approach was successful in raising awareness and residential participation and created a sense of enthusiasm around recycling. Recycling tonnage in multi-family houses increased by 7.25% within six months, and contamination of recyclable materials dropped from 19.6% to 8.4%.⁵⁹

Orange County, North Carolina, is an example of a high estimate of potential waste diversion. Using this figure, it is estimated that the Town could achieve a 0.61% diversion rate by implementing this recommendation and a 0.21% diversion rate using a lower estimate, such as that in Culver City, California's, example. The diversion rates depend heavily on the level of participation of building residents.

^{xvi} The impact from the program was estimated from Orange County and Culver City California. The cost of the program includes buying and distributing the totes/bins. The revenue generated is due to the reduced tipping fee from the estimated volume of waste reduced. The waste reduction impact ranges from 0.21% to 0.61%.

Achieving the higher diversion rate could become more attainable if the Commission develops an outreach campaign with the help of a coordinator to educate managers, residents, and owners of multi-family homes on the ease of using the bags and to illustrate the incentives for better recycling.^{xvii} For maximum success, the Town should work with multi-family building managers to reinforce a recycling culture within the community. Depending on the success of the program, its expected net cost/revenue ranges between -\$3,481 and \$4,764 over a five-year period.¹⁴

Case Study: Orange County, North Carolina

Orange County, North Carolina, started outreach through onsite newsletters, brochures, and blurbs and also distributed small bins and tote bags. This cost Orange County \$0.60 per household for convenience of transport to collector bins in 2006 and resulted in a 20% increase in recycling rates.⁶⁰

^{xvii} Incentives include “Oops” stickers resulting in non-collection, which is detailed in the following recommendation, and Pay-As-You Throw, which was previously discussed.

Recommendation 2: “Oops” Sticker Enforcement^{xviii}

The County’s Department of Environmental Facilities, currently operates an initiative to increase recycling enforcement and increase source separation, as is required by County law. “Oops” stickers, such as those displayed in **Figure 8**, are utilized in other towns within the County, such as Rye Brook, Tarrytown, and Rye City, as a reminder for when waste is not properly disposed. This can be in situations when recycling bins have trash in them or vice versa.

At the County level, however, the stickers are issued at the transfer station to the haulers and not to residents. For repeated infractions, there are fines ranging from \$250 for one offense up to \$1,000 for a fourth offense. Municipalities, private haulers, large waste generators, and individuals face the same penalties for errant garbage.⁶² Westchester County towns with private haulers like Rye City and Rye Brook issue stickers to residents in order to avoid these fines and they help drive high recycling rates in these towns. Mamaroneck could consider a similar fine structure for residents and non-residential entities, perhaps after the first year of “Oops” sticker implementation, adjusting it to meet the Commission’s needs.

The Town is recommended to start using these stickers to reinforce correct recycling practices and ensuring source separation. On designated collection days, the hauler will place “Oops” stickers on recyclable material containing bins that are not properly separated or contain trash and will not be collected until the following collection day as shown in Figure 5.^{63,64} The same also will be done for the PAYT bags. “Oops” stickers will be placed on PAYT

Case Study: Westchester County, New York

Westchester County provided over 120,000 red “Oops” stickers to municipalities and private haulers throughout the County in 2008, and towns that were served predominantly by private haulers undertook this sticker campaign. In 2008, 7,149 loads were inspected at County transfer stations. Of these loads, municipalities hauled 3,343, and the remaining 3,806 were hauled by licensed private haulers. In 2008, recyclables diversion increased by 18.4%, largely attributed to the implementation of this recycling enforcement. This initiative saw savings of \$1.1 million in that fiscal year.^{62, 63}

^{xviii} The increased recycling rates were obtained from Westchester County and the waste reduction for the Town was extrapolated. The revenue generated is due to the reduced tipping fee from the estimated volume of waste reduced. The waste reduction impact is 2.18%.

bags that contain materials that could have been recycled. The “Oops” sticker acts as an opportunity to inform residential and non-residential entities in the Town of why their waste was not collected. This could be due to a number of reasons such as improper source separation, incorrect cart placement, improper packaging of recyclables, and/or unacceptable materials found in the respective carts. These stickers will educate residents on how to sort waste correctly and will ensure future contamination does not occur in the various waste streams. The “Oops” sticker program may not have a direct correlation to the Town’s Near Zero Waste goals, but it will have an impact on residents. If residents have a negative perception of having excess waste on their property for an extra week, they could deliver the waste to the Maxwell Avenue recycling facility after it has been properly separated.

The recommendation would require minimal initial investment from the Town since the stickers are made available by the County, and depending on the success of the program, could generate offsetting revenue for the town of up to \$40,009 over a five-year period.¹⁴



Figure 8: Westchester County "Oops" stickers informing residents why waste was not picked up

Recommendation 3: Student Involvement and Recycling Education in Schools

Education is very important to the Town; it is recommended that Mamaroneck use its waste management programs for learning opportunities within the community and beyond. Currently there are approximately 5,200 students in the Town's school system, and the Commission picks up recyclable materials from four schools.⁶⁷

By expanding the current recycling program to include bins for compostable waste and with clearly labeled separate bins for paper, commingled recyclables, and food waste, the schools will be able to create continued opportunity for growth and education. Engaging students in activities such as composting and cleanup days will boost their knowledge and enthusiasm with regard to recycling, which would then be taken back home to their families. The Commission, in partnership with the schools, could engage students on annual event days, such as America Recycles Day and Earth Day.

School recycling programs are a unique learning experience for everyone involved. Students, faculty, staff, and parents not only learn about recycling but also about sustainability in the community. The schools represent a logical medium to easily educate on what materials can and cannot be recycled, why and how students should recycle, and most importantly, how to apply this knowledge at school, at home, and beyond. Educating residents through educating children is an approach the Town could actively pursue by introducing formal

Case Study: New York, New York

New York City offers its schools an RRResource Guide with lesson plans and activity sheets that comply with Department of Education standards. The guide includes videos, coloring books, comic books, and ideas for hands-on projects and long-term activities. New York also brought environmentally friendly changes to schools citywide starting with compostable trays that students can throw in the designated composting bin. Compostable trays typically cost \$0.15 per tray versus foam trays at \$0.03 each, but foam trays contain a carcinogenic chemical called styrene, which ends up in landfills and contaminates the local air and water quality. With a bid submitted for 271 million trays, the cost of compostable trays came down to \$0.04 each making the initiative possible. It will be in the Town's best interest to also purchase trays in bulk. To bring the Town closer to Near Zero Waste, one step for the schools to take is to shift to compostable trays and utensils in the cafeteria, which complements the composting food waste in school program.⁶⁶

recycling talks periodically at each school.⁶⁸ Furthermore, schools could partner with the Commission in spreading the message to eliminate non-reusable plastic water bottles and non-reusable materials, such as Styrofoam plates and cups, in cafeterias and teachers' lounges. Disposable trays from alternative materials such as compostable plates, cutlery, and cups can be used instead and serve as an opportunity to increase composting and learning in schools. The Recycling Coordinator should be the liaison for a successful school-recycling program along with educating the kids. This will ensure all intended programs are covered and are running in parallel to the Town's recycling programs.

Although this recommendation does not have a direct impact on disposed waste, it does boost significant behavior modification in the system through children and, ultimately, their families.⁶⁹ Implementing recycling programs and embedding recycling in education in schools offers students a hands-on-opportunity to contribute to the schools' waste diversion efforts while also helping them learn more about sustainability. The intent of teaching students about waste and recycling options is to ensure that they understand how waste impacts the environment and, in turn, their future. Students can realize the human-environment connection and recognize the impact that a single individual can have towards reducing overall environmental impacts. The earlier these recycling habits are established in a child's life, the greater the likelihood they will stay with him or her in the future.⁷⁰

Recommendation: Pay-As-You-Throw Municipal Solid Waste Program

Using a PAYT municipal solid waste collection program to enhance their current backyard pickup will move the Town closer to the Near Zero Waste goal by creating an incentive for residents to reduce their consumption of non-recyclable resources, therefore it is recommended that the Town implement a volume-based PAYT program. PAYT typically results in a 14-17% reduction in discarded solid waste and a 32-59% increase in recycling rates, on average.⁷¹ The main impact to residents is that PAYT bags would need to be purchased as a substitute for traditional garbage bags at designated local retailers and municipal buildings. In order to educate households and businesses on how the program will impact them, the Town is advised to hold public meetings, distribute written materials, issue a press release, and collaborate with local retailers.⁷² Table 8 summarizes the waste diversion potential, costs, and offsetting revenue associated with instituting this PAYT program.^{xix}

Table 8: PAYT - Waste Diversion and Financial Impact¹⁴

Recommendation	Single-Family / Multi-Family / Non-Residential	Maximum Waste Diversion Potential	Total 5-Year Cost	Total 5-Year Offsetting Revenue	Net Cost / Revenue
Pay-As-You-Throw					
PAYT Multi-Tiered Bag Program (Low Estimate)	Single-Family, Multi-Family, and Non-Residential	5.22%	\$(581,492)	\$4,883,007	\$4,301,515
PAYT Multi-Tiered Bag Program (High Estimate)	Single-Family, Multi-Family, and Non-Residential	6.33%	\$(581,492)	\$4,903,524	\$4,322,032

The Town could implement this program using multi-tiered pricing and pre-purchased PAYT bags. In order to create a PAYT program tailored to the needs and infrastructure of the Town, the team researched over twenty municipalities that have implemented PAYT programs. These municipal programs were analyzed based on the goals of the Near Zero Waste initiative, demographics, current level of service, and waste management infrastructure of each town against the costs and benefits of implementing its PAYT program. The backyard, multi-tiered (aka hybrid) pricing model was chosen

^{xix} The low and high waste reduction impacts were determined using EPA estimates for similar programs. The pricing and multi-tier approach was developed based on case studies from Natick, MA, Gloucester, MA, and Southold, NY. The costs were based on bag requirements extrapolated for Mamaroneck based on data from a case study on Ashland, MA, and bag prices from the Massachusetts State Contract for imprinted plastic PAYT bags. The revenue generated is from the reduced tipping fees and the payment for bags purchased by the residents. The tax reduction potential is determined by taking the net revenue generated by the PAYT program over five years, dividing it by 5 to come up with an annual average net revenue, and dividing by the population. This could be instituted to minimize additional costs of the program borne by residents. The waste reduction impact ranges from 5.22% to 6.33%.

because it will be cost-negative. The program will lower costs for the Town and for residential and non-residential waste generators through reduced tipping fee expenditures. In addition, the program can be implemented using the existing waste collection infrastructure. Through the PAYT bag sales, the town will generate significant offsetting revenue that can be passed on to residents in the form of a tax reduction. In this way, residents are incentivized to produce less waste, because the purchase of fewer bags, can result in a net decrease in taxes.



Figure 9: Examples of PAYT bags^{73,74}

In the future, it may be in the Town’s best interest to consider handling recyclables “in-house” or negotiating a higher, variable rate based on the amount of recyclables that the Town sends to the County. This will significantly increase the revenues that the Town receives from recyclables and their PAYT program. In addition, this could allow for more cost-intensive PAYT programs to be explored. Research has shown that weight-based container programs do not have significantly higher outcomes than volume-based bag programs and the weight-based systems are much more capital-intensive due to the high costs associated with container purchases, retrofitting of trucks with new equipment including scales, mechanical arms, etc., and administrative expenses to track billing.⁷⁵ With a different infrastructure in place, however, this and other program enhancements may be viable. For example, following a comprehensive waste audit, the Town might want to perform a cost-benefit analysis of a PAYT system that uses variable-rate pricing, and/or a weight-based system, in order to gauge the financial and environmental benefits and costs associated with more capital-intensive programs.⁷⁶

Currently, the Town utilizes backdoor collection of residential solid waste. There is no limit to the amount of solid waste that residents are permitted to dispose. Therefore, there is no incentive to reduce disposed waste and/or increase recycling among residents. If the Town adopts the recommended PAYT system, there would be no change in the current waste collection system for all households and businesses that have their waste collected by the Town. The biggest change would be that the Town would have to purchase PAYT bags, make them available at the Maxwell Avenue

facility, while also partnering with local retailers to make the bags available to residents and businesses to purchase. In addition, the Town should create a PAYT task force and develop a public outreach campaign to educate households and businesses on how the PAYT program will work.

To effectively implement a multi-tiered, PAYT program, the Town could purchase two different sized bags in bulk, to be sold to residents and businesses at local retailers and municipal buildings.⁷⁷ The recommended price of Town PAYT bags was calculated by comparing PAYT bag prices in Southold, New York, Natick, Massachusetts, and Gloucester, Massachusetts. Based on these programs, it is recommended that the Town's bags be priced at \$1.00 for a 15-gallon bags and \$2.00 for 30-gallon bags.¹⁴ This will create an incentive for residents to recycle and reduce the amount of waste they dispose to avoid having to purchase the larger bags. While the cost per pound is consistent, the capacity to use the smaller bag from reducing the volume of waste produced represents an immediate cost saving. In the future, it is recommended that in order to establish a more accurate pricing schedule based on Town-specific waste stream data, the sizing of the bags along with specific pricing could be determined after the completion of the recommended waste audit. This would confirm that the data utilized in calculating total quantities of residential waste and corresponding costs are accurate.

In order to gauge the number of bags the Town should purchase, data on bag requirements for the town of Ashland, MA was scaled proportionally for the number of residents in Mamaroneck. Based on this analysis, a total of 216,000 15-gallon bags and 371,000 30-gallon bags would be required annually.^{14, 78}

In addition, a local ordinance should be created to establish a penalty for illegal diversion. Curbside waste collectors need to

Case Study: Gloucester, Massachusetts

The City of Gloucester, Massachusetts, has a population of 28,789 residents. Gloucester provides residential curbside trash and recyclable collection for 13,000 households. The city implemented a PAYT two bag system with the help of the non-profit, WasteZero, Inc., in 2009. The city realized a 37% reduction in trash volume after the first month of implementation. After the first year of implementation, the city reduced its solid waste tonnage by 26% or 2,373 tons resulting in \$163,000 in avoided tipping fees. From 2009-2011, Gloucester successfully reduced its annual solid waste by more than 2,000 tons with an annual savings of close to \$140,000 each year.

be trained to identify and enforce violations against illegal diversion practices such as:

1. Exceeding size or weight limitations for containers placed out for collection,⁷⁹
2. Illegally dumping or burning trash, and⁷
3. Placing items in recycling bins that are not listed for recycling under the program.⁷

The PAYT program is a cost-negative program because the cost of the program is covered by the price of the PAYT bags, which are substituted for the bags that residents already purchase. The program is expected to generate between \$4,301,515 and \$4,322,032 in net offsetting revenue over a 5-year period.^{xx, 14} The offsetting revenue is achieved through a reduction in tipping fee expenditures and the sale of the bags.

It is recommended that offsetting revenue be used as a means of reducing taxes for residents. Over the five-year period, this could result in offsetting revenue equivalent to 27% of the Commission's annual budget and could result in an estimated tax reduction of \$116 per household, which can be reflected in the tax bill at the start of the program inception year or following the first year of the PAYT program.^{xxi, 14, 801}

Although the proposed PAYT program reduces costs, increases revenues, and operates within the existing infrastructure of the Town's current collection system, there are challenges. The main obstacle to successful implementation is illegal diversion. This refers to the illegal dumping of trash, burning of trash, overfilling of PAYT bags, and/or filling PAYT bags with illegal bulky items.⁸¹ Based on benchmarking research, illegal diversion is a solvable problem. According to a Duke University study on PAYT communities, 48% of the participating cities and towns saw no change in illegal diversion while 6% felt that it declined after PAYT implementation.⁸² Consequently, the proper training of curbside collectors along with consistent enforcement will ensure that participants divert their waste properly.

^{xx} Calculations were based on the assumption that the Town would purchase 5-years worth of PAYT bags prior to program inception. This will require the Town to set aside a dedicated space to house the 49 pallets of bags.

^{xxi} Household tax reduction based on the estimated total average annual tax reduction attributable to the residential portion of the Town divided by the total number of single and multi family homes.

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Implementation



While each recommendation has significant value when implemented independently, the following implementation plan provides a logical pathway for introducing the projects to maximize community involvement and increase the success of the Near Zero Waste strategies. The overall strategy is to maximize waste impact while minimizing the cost associated with implementing it. Through this designed implementation plan, it is expected that all programs will be in place within two years. This will be most effective with the recommended one dedicated, full time staff member, a Sustainable Waste Project Manager, to oversee the projects and provide technical support on each of the programs. With an annual salary and benefits package of \$58,024, this staff member will cost \$290,120 over the five-year period.¹

Implementation should begin by conducting a waste audit to verify the assumptions made to determine the baseline estimates of discarded waste. It is estimated that the planning for a waste audit would take approximately one to three months before implementation can begin. If major discrepancies in waste category estimates are found, a degree of correction of the recommendations or implementation plan may be required. While conducting the waste audit, planning should be underway for implementation of the other recommendations.

Assuming the estimates are verified, the town should begin introducing programs that target waste streams that currently do not have recycling programs in place, including textile recycling and food composting programs. This will ensure that when PAYT and the “Oops” sticker recommendations are implemented, the maximum number of waste categories will have options for diversion. During this time, the town can also focus efforts on building a recycling culture and enhancing the Commission’s social media’s presence.

Once the textile and food composting recommendations have been successfully implemented and the Town has begun efforts to bolster social media and create a movement around the near zero waste strategy, it should move forward with the PAYT and the “Oops” stickers program. This phase is expected to take six months.

By the second year, most programs will have been implemented and will be in a stage of maintenance, evaluation, and modification to ensure that the programs are working optimally.

A timeline associated with the above implementation strategy is displayed in **Table 9** below. Detailed implementation plans for each recommendation are listed in Appendix 4 of the report.

Table 9: Implementation Strategy

YEAR 1				
Quarter	1	2	3	4
PAYT			Program Design	Public Education
Improving Existing Programs	ii.			
Build a recycling culture	Planning	Implementation	Follow up and Maintenance	
Oops Stickers			Introduction	
Social Media Enhancement	Planning	Implementation	Follow up and Maintenance	
Textile Recycling	Program Design	Pilot Program		Pilot Program Expansion
Food Composting	Program Design	Implementation	Evaluation	Education and Communication
Waste Audit	Program Design	Implementation		
YEAR 2				
Quarter	5	6	7	8
PAYT	Logistics Meeting	Implementation		
Improving Existing Programs	iv.			
Build a recycling culture	Follow up and Maintenance			
Oops Stickers	Program Design	Outreach Planning	Implementation	
Social Media Enhancement	Follow up and Maintenance			
Textile Recycling	Implementation			Evaluation
Food Composting	Education and Communication			
Waste Audit	Evaluation: Analyze and Build Customized Recommendations			

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Communication

Make a positive impact.

Enhancing Communications and Outreach

Communication with residents is a key factor for successful implementation of all of the Near Zero Waste recommendations in order to achieve the necessary behavior changes among residents. Residents of the Town should be made aware of the benefits of the Near Zero Waste programs for themselves and for the entire community. This will instill a greater commitment to behavior change that will ensure the recommendations achieve their intended waste reductions.

The Town should engage and educate different community groups, which could involve a combination of community meetings, mailings, Town website updates, email newsletters, and social media campaigns. In addition, education programs could be implemented through local school districts to engage students, faculty, and their families. Targeted stakeholders include but are not limited to:

- Municipal workers impacted by the program (sanitation personnel, outreach staff)
- Household residents
- Multi-family residents
- School faculty and staff
- Local business owners
- Volunteer fire department personnel
- Seasonal residents
- Low-income residents
- Private haulers and recyclers

Given the Internet's unavoidable prevalence in modern society, it is important to develop a social media presence to share information with the residents of the Town regarding the Near Zero Waste plan and any changes that will be made to the waste and recycling system.¹ According to the Pew Research Center, 88% of American adults have a smartphone and nearly 79% of American adults own a laptop or tablet.² Online and social media communication campaigns are a tool the Town could use to share stories, illustrate experiences, and build relationships with the community. A communication plan allows the Town to raise public awareness, gain support, promote success stories, deliver calls to action, and inspire behavior change.

The Commission should provide residents with information directly to their mobile electronic devices regarding the Near Zero Waste strategy and how they can participate in more efficient recycling and composting practices. Weekly updates and relevant news stories should be posted on all social media outlets to distribute information to residents and businesses, including upcoming events, helpful tips, recycling schedules, and links to recycling resources. Digital and social media require daily maintenance in order to gain a significant following and to offer curated content

specific to followers' interests. Other information that could be incorporated to support this could be zero waste success stories in communities locally, nationally, and internationally.

The Town currently does not have a strong presence on Facebook or other social media, but building this presence could help to gain community support for the Near Zero Waste recommendations. This can be achieved through setting targets for social media “followers” throughout the phases of the implementation plan in order to ensure the content is reaching its intended audience. Social and digital media marketing is free, and there has been no budget line item for this communication program. It is estimated, however, that there would be a minimal internship or trainee fee that can be added in.

Communication Strategy

Most social marketing programs target a 5% rate change within 2-3 years based on focused and consistent communications programming.³ To ensure effective engagement of the target audiences (in this case town residents), the communications strategy should incorporate all of the following objectives:

Knowledge Objectives:

Waste reduction and diversion options, community waste reduction targets and progress towards the same, ecological and economic impacts of inappropriate waste management, means of improving participation in waste reduction and diversion, and personalized benefits of reducing household waste.

Behavioral Change Goals:

Inspired to help achieve the community waste reduction and diversion goals, convinced that other people “just like them” are already reducing waste, and to be aware that their actions make a difference.

Action Objectives:

Initiate and sustain waste reduction and diversion efforts, reduce the amount of waste generated in the first place, and recycle the correct materials in the correct bins.

The University of Michigan conducted a study related to best waste practices with the goal of increasing recycling rates.⁴ Communication turned out to be a big reason for better recycling and positive habit changes. Some best practices discussed were

- Create a communication strategy that should distribute up-to-date recycling information; this includes making recycling information accessible via electronic newsletters and encouraging/incentivizing residents to sign up for emails. This would ensure all residents are aware of any changes. According to research done by Neilsen Norman Group on effectiveness of email and e-newsletters; 69% of users said that they look forward to receiving at least one e-newsletter, and most users said an e-newsletter had become part of

their routine.⁵ Thus, going online could prove to be a better communication strategy than paper newsletter.

- Identifying one or more environmental champion(s) within the town to help disseminate recycling information in another proven communication strategy recommended. A study done in UK that measured the effectiveness of environmental champions found that, "an average waste reduction of 37.96% was achieved across all of the Environment Champions' waste programs, with a maximum saving of 70% and a minimum of 13%.⁶

In addition to sharing 'to-do' lists and reminders, it is equally important to share success stories and let residents know when their actions are leading to recycling success. This could motivate residents to continue creating a positive recycling culture at a town level.

Table 10 highlights several successful communication strategies that were utilized in order to implement waste reduction efforts similar to those recommended to the Town.

Table 10: Examples for Communication Strategy

Textiles
<p>Wearable Collections: The program is set up through Wearable Collections and is initiated by reaching out to local media outlets (both print and digital), promoting via all social media outlets and by building a dedicated webpage. To maximize collections, various hub points can be set up such as green markets, schools, community collections and retail partners. Mailing lists and giving out flyers at events have also been found to be effective.⁷</p>
Food Waste
<p>Langley, Canada: A study undertaken to increase participation rate in the town’s existing backyard composting program found that the major barrier was lack of knowledge. However, this was not due to lack of readily available materials on backyard composting in the web or in print, but it was getting the right information to the people most effectively. A pilot study concluded that door-to-door visits, personal communication, and follow-up resulted in a garbage reduction of 31% (3.51 kg/household/week) with a 51% household participation rate.⁸</p>
Improving Existing Programs
<p>Culver City, CA: Culver City, California, is a small, densely populated city where 60% of the housing units are in multi-family buildings and many properties do not have recycling services. A lot of preparation was needed for the start of mandatory multi-family recycling, which went into effect in July 2012.⁹ The Department of Public Works, which collects all residential recycling in the city, received a state grant to increase the number of properties signed up for recycling by providing free service for a limited time. Culver City launched a communications and promotion campaign to increase visibility and awareness about recycling and fostering community engagement in order to make recycling second nature for residents.¹⁰ The ultimate goal of the program was to increase the number of properties with recycling service and to increase the amount of recyclables collected from each property. Six months into implementation, the city successfully recruited and enrolled 28 complexes, reaching 3,420 units (approximately one-third of all units in the area).¹¹</p> <p>Toronto, Canada: Toronto recognized that apartment residents themselves could be among the most effective champions of recycling, because they can connect directly with their neighbors and potentially address the unique physical, cultural, and communications characteristics of each building.¹² Keeping this in mind, the city created the 3Rs Ambassadors program, which would recruit volunteers from apartment and condo buildings across the city to train and educate them to engage peers in their own buildings on reducing, reusing, and recycling, hence the name 3 “Rs”.¹³ Each ambassador was encouraged to use creative approaches tailored to their specific building and its residents. During the recruitment and training of the ambassadors, Toronto also launched a recycling guide in the form of a 12-month calendar full of tips and messages about recycling and waste prevention that was sent directly to every apartment and condo resident.¹⁴ The first month included a full-page spread promoting the 3Rs Ambassadors program and inviting residents to volunteer. The ambassadors helped with reusable tote bag distribution, multimedia communications, and educating residents about the benefits of recycling. Multi-family recycling rates increased from 16% in 2009 to 20% in 2011 and most buildings participating in the program saved 15% on their garbage bills.¹⁵</p>
Pay-As-You-Throw
<p>Gloucester, MA: In 2008, Mayor Kirk and the team at the Department of Public Works publicly introduced the proposed conversion from PAYT stickers to PAYT bags in order to gain support from the town council. At the council’s request, WasteZero Inc. provided a detailed analysis of the operational and economic benefits of converting from stickers to plastic bags. A series of public hearings and community meetings were held, targeted media and citywide mailings were sent, and informational flyers were publicly posted over the next six months. The council approved the conversion in July 2008.¹⁶</p>

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Conclusions



Conclusions

This report puts forth a strategy that positions Mamaroneck to make significant progress towards its goal of Near Zero Waste by 2018. While it falls short of achieving the target of diverting 90% of waste from the WtE facility, it offers concrete recommendations, which if implemented, can move Mamaroneck from its current diversion rate of 63% to 74%, making it the top-performing municipality in Westchester County.¹

The strategy recommends programs to recycle textiles and compost food waste, thereby providing residents with new ways to reduce their discarded waste. Through the collection and recycling of clothing, bedding, carpeting, and food scraps, Mamaroneck is expected to remove over 560 tons of material from its waste stream annually.¹ When combined with Mamaroneck's existing recycling programs, the Town will provide its residents with the ability to recycle nearly all of the waste categories classified within the EPA's national municipal solid waste report.²

Achieving Near Zero Waste, however, requires going a step further than introducing programs targeting new waste streams. Mamaroneck must also reinforce its current recycling programs with policies that ensure that all residents actively participate. Therefore, several recommendations in this report are geared toward driving up participation rates. The report recommends making recycling easier in multi-family homes through the distribution of recycling bins and tote bags, discouraging unsustainable waste disposal practices through the use of "Oops" stickers, and engaging the community through outreach and communication efforts.

The strategy also recognizes that financial incentives are often a significant driver of participation. It therefore recommends that the Town shift the way that residents pay for waste disposal toward a volume-based PAYT program. Such a program would allow residents to pay for a portion of the Town's waste management through the purchase of garbage bags and, in return, receive a tax reduction. In this way, the financial benefits to each resident are proportional to his or her success in reducing the volume of waste discarded.

This report suggests a practical plan for implementing the Near Zero Waste strategy. It identifies existing partners in the Town's surrounding area to support several of the recommendations, shares best practices for communicating with residents, and suggests an implementation timeline that will have all programs operational within two years. Finally, it offers longer-term strategies to close the gap and move closer towards the target of 90% diversion of discarded waste from the WtE facility.

Each recommendation put forth in this report is backed by detailed research of programs implemented in comparable communities in the region, across the U.S., and around the world. A simplified cost-benefit analysis was done for each recommendation to make sure that the waste impact achieved was justified by the costs involved in implementation. As a result, the entire strategy, including implementation costs, is estimated to produce offsetting revenue for the Commission of \$3.9 million over five years. The PAYT program is estimated to generate enough revenue from the sale of bags to reduce each household's tax bill by an estimated \$116 per year.¹

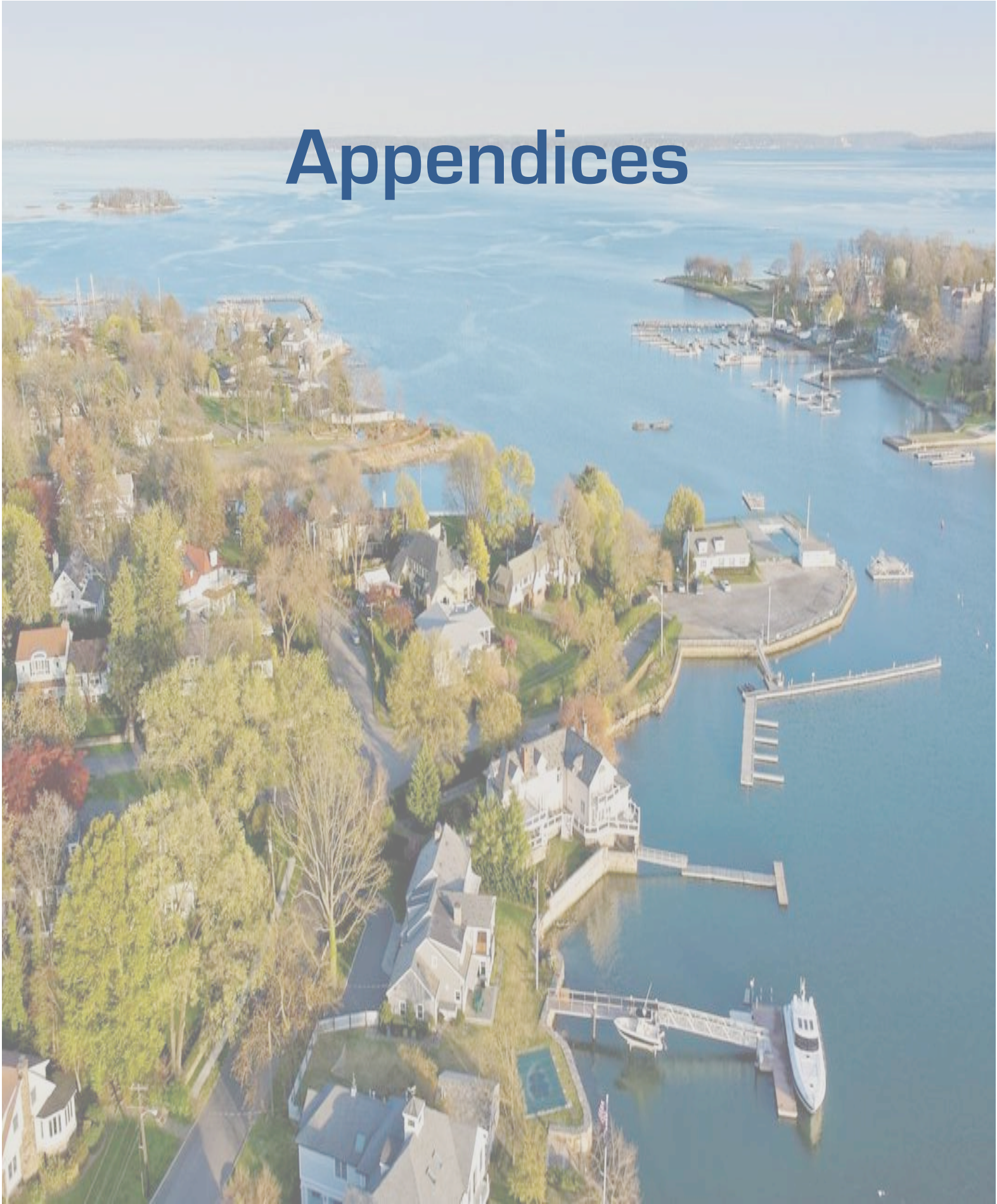
Mamaroneck's Near Zero Waste strategy addresses a critical environmental concern in the community, while being mindful of the economic well being of the residents. In doing so, it will position the Town's waste management system to be a sustainability model for all municipalities in Westchester County and beyond.

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Appendices



Appendix 1: Maps

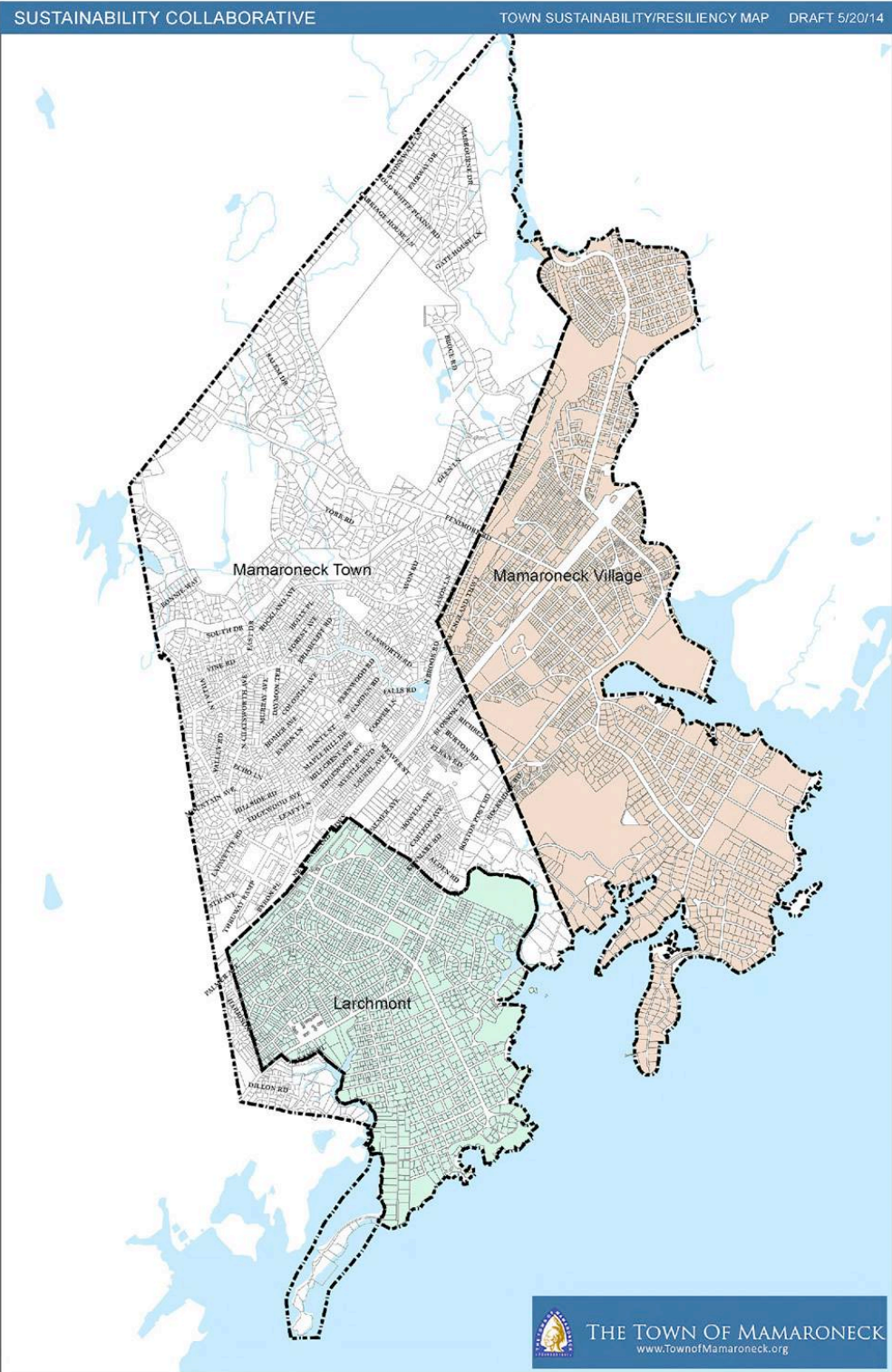


Figure 1: Town of Mamaroneck map¹

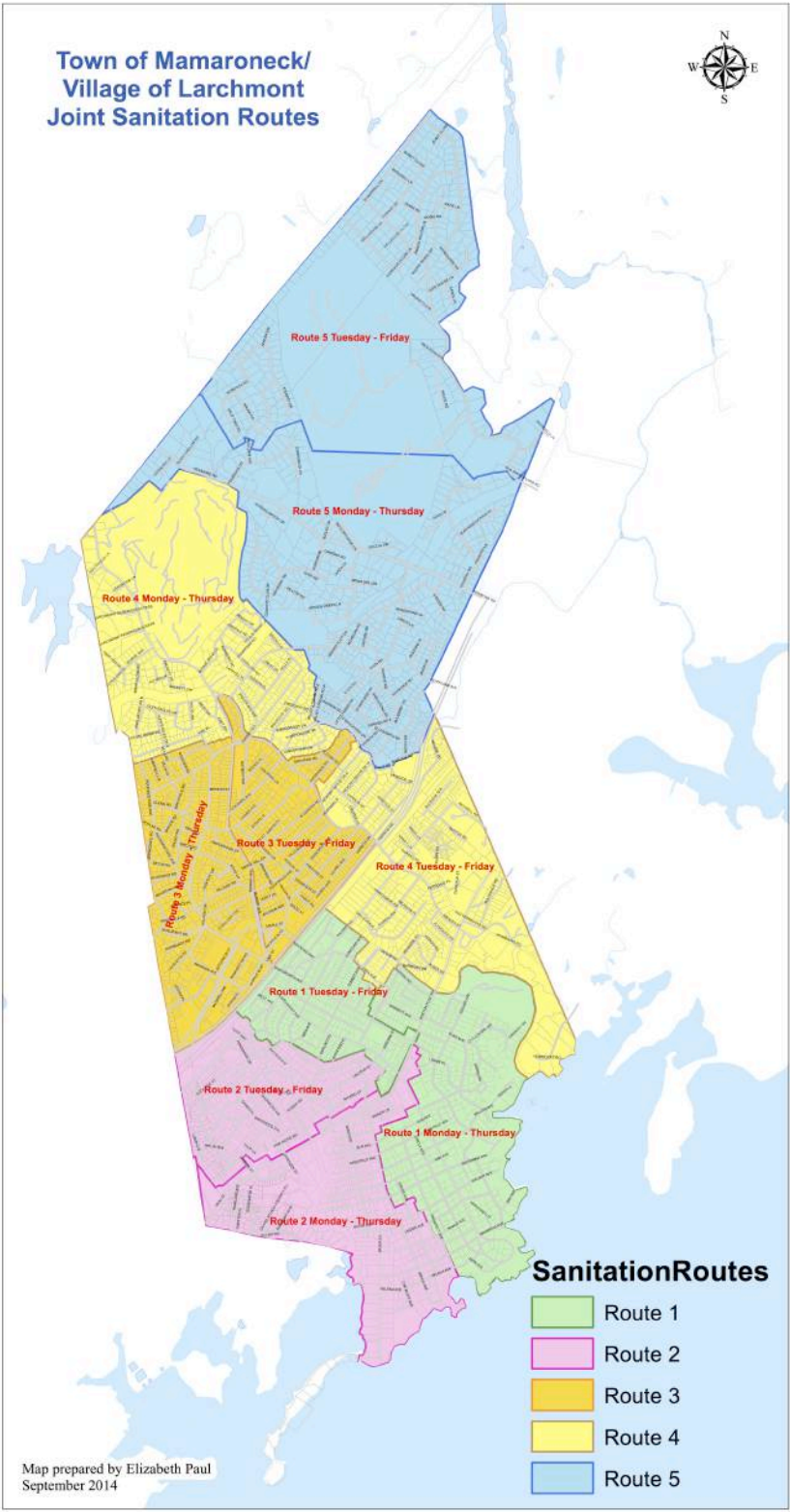


Figure 2: Town of Mamaroneck Sanitation Routes map²

Appendix 2: List of Completed Interviews

NAME	TITLE	DEPARTMENT/ORGANIZATION	ASSOCIATED GEOGRAPHIC AREA
Jim Bunchuk	Solid Waste Coordinator	Solid Waste District	Southold, NY
Anna Giordano	Founder	We Future Cycle	
Terry Miller	Recycling Committee Board Chairwoman	Natick Recycling Committee	Natick, MA
Steve Wolk	Chairman	Sustainability Advisory Board	New Castle, NY
Diane Chickering	Account Representative and Recycling Coordinator	Suburban Carting Co. (or Sani-Pro)	Select municipals within Westchester County, NY
Nina Orville	Principal	Abundant Efficiency	Southern Westchester Energy Action Consortium
Jean Hamerman	Interim Chair	Sustainable Westchester	Hastings, NY, and Westchester County, NY
Jill Shapiro	Town Administrator		New Castle, NY
Blair Pollock	Solid Waste Planner	Solid Waste Department	Orange County, NC
Marianne Petronella	Director	Resource Management	Westchester County
Camillo	Council Zero Waste Campaign Head	Capannori Council	Capannori, Italy
Adam Baruchowitz	CEO	Wearable Collections	New York, NY
Michal J. Nowak	Superintendent	Public Works	Rye Brook, NY
Stephen V. Altieri	Town Administrator	Town Board Sanitation Commission	Mamaroneck, NY
Mike	General Foreman	Highway/Sanitation	Town of Mount Pleasant, NY
Kim Angliss-Gage	Recycling Coordinator	Refuse and Recycling	Town of Yorktown, NY
Randi Mail	Director	Recycling	City of Cambridge, MA
Grey Russell	Sustainability Officer		Montclair, NJ
Nima Upadhyay	Special Projects Coordinator	Public Works	Takoma Park, MD
Marty Kiernan		Kiernan Farms	Gardiner, NY
Bronwen Concourse		Fullmoon Farms	Gardiner, NY
Gerardo Soto		NATH Sustainable Solutions	
Sean Ragiel	Founder and CEO	CarpetCycle	NJ
Anthony Cline	Operations Manager	Carpet America Recovery Effort	National

Appendix 3: Assessment of Feasibility of a Private Hauling System

In 2011, the Town of Mamaroneck and Village of Larchmont achieved a recycling rate of 63%, placing them in the top ten municipalities in Westchester County. Four of the other top-performing municipalities were interviewed, and three of them, including Rye Brook at 69%, Mt. Pleasant at 64%, and New Castle at 62%, have privatized their waste collection operations. All of the top three performing towns, Scarsdale at 76%, Bronxville at 73%, and Briarcliff at 72%, still manage their own waste collection operations through each municipality's Department of Public Works.³ Nevertheless, it is important to determine whether privatization is a feasible and cost-effective option for the Town of Mamaroneck.

Marianne Petronella of the Westchester County Department of Resource Management indicated that several Refuse Disposal District (RDD) member municipalities contract out the collection of waste, whether it is for garbage, recyclables, yard waste, or other waste categories.⁴ Companies selected through a Request for Proposal are permitted to deliver this waste to the County transfer stations. The Inter-Municipality Agreement contract allows municipalities to contract out the service of solid waste and/or recyclables collection as long as all materials are delivered to the County transfer station.

Rye Brook and Mount Pleasant are both members of the RDD and have privatized their operations. Both towns focus extensively on outreach programs and have their own private yard waste compost facility. Rye Brook privatized its entire sanitation operation over ten years ago. Michal Nowak, the Superintendent of Public Works for the Village of Rye Brook, indicated that it is less expensive for the Village to contract out the collection and delivery because they no longer have the manpower or equipment to do the work.⁵ The bid is \$2.3 million for 3 years, which for this town is less costly than managing it in-house. The private contractors, who are accountable for fines imposed by the County if recyclable materials are mixed with disposed waste, are also responsible for promoting recycling. They will not pick up trash if recyclables are not separated because of the fines from the County.⁶ Mount Pleasant operates in a similar manner, except that it does not provide pickup services for non-residential entities.

Assuming the operating cost per capita in Mount Pleasant is the same for the Town of Mamaroneck, it would cost the Town approximately \$4.5 million annually to privatize collection.⁷ Since the Commission's expenditures in 2011 and 2012 are both approximately \$3.1 million, it costs more to privately contract out the operations than manage it publicly. Also, the difference in waste diversion percentage between a privatized operation and the Town of Mamaroneck is within 10% as aforementioned. This could offset the cost of the tipping fee but not enough to justify an additional cost of \$1.4 million to privatize. The most effective practice associated with privatization is the refusal to pick up from residents whose recyclables are not separated from the trash. A recommendation shall be made to address a stricter collection operation. Therefore, the

recommendations assume continuation of public collection to reduce the 37% of Mamaroneck's waste stream that is sent to the WtE facility.

Appendix 4: Detailed Implementation Plan

Waste Audit Detailed Implementation Plan

Phases	Strategies
<p>I Program Design (Month 1)</p>	<ol style="list-style-type: none"> 1. Introductory Meetings <ul style="list-style-type: none"> • Seek Task Force members (both official and voluntary) to oversee the process • Ensure members include representatives of residential and non-residential buildings; dependent on buildings chosen for each phase • Overview of existing solid waste/recycling activity • Introduce need and objective of a waste characterization study including what data are to be collected • Identify the appropriate statistical sampling method for the community (at transfer stations, from trucks, from neighborhoods, etc.)⁸ 2. Program Design Meeting <ul style="list-style-type: none"> • Identify Waste Study Goals • Identify potential legal, privacy, and other obstacles • Discuss Methodology options; EPA Waste Wise Program,⁹ Town-managed, independent consultant, or hire consulting company • Review different waste characterization case studies • Discuss funding issues • Review and finalize timelines 3. The basic steps involved in conducting a waste audit are:¹⁰ <ul style="list-style-type: none"> • Collecting ensuring confidentiality of all waste analyzed • Sorting by location • Further sorting by type; recyclable and non-recyclable • Analyzing results to answer the following questions: <ul style="list-style-type: none"> ○ What is the composition of the waste stream? ○ How much can recycling be increased? ○ How can waste be collected more efficiently? ○ How much money could altering waste management practices save? • Prioritizing solutions such as alternate markets for diverted waste based on the amount, ease of implementation, and costs involved¹¹

<p>II Implementation (Month 1)</p>	<ol style="list-style-type: none"> 1. Finalize logistical details <ul style="list-style-type: none"> • Place of sorting: all collected waste can be sorted at the Maxwell Avenue recycling center • Introduce Task Force members, objectives, and timelines at a Town Hall meeting • Summarize and share the Waste Characterization Study program design decisions 2. Stakeholder Impact Meeting <ul style="list-style-type: none"> • Discuss approach to engage Multi-Family Housing • Discuss approach to work with local businesses by encouraging dialog and discussion of benefits • Discuss the impact of seasonal waste • Analyze existing operations • Create a plan to work with local haulers • Further develop the social media platform to raise awareness • Start the process by collecting and analyzing monthly samples of waste for particular building type(s) • Each building could have a waste study performed 1-3 times throughout the year to get an accurate and unbiased picture 3. Hold monthly Town Hall meetings to show photos of and educate based on the waste audit findings
<p>III Implementation Logistics (Month 2 onwards)</p>	<ul style="list-style-type: none"> • Work with retail establishments, building managers, and local homeowners within the Task Force on administrative issues • Program maintenance, monitoring, and measurement • Ensure availability of gloves, bins, sorting sticks, and dedicated waste sorters • Be mindful of the challenge of not having experience in having done this previously and emphasize the value in learning what is gained through completion of the audit
<p>IV Build Customized Recommendations (Month 13 onwards)</p>	<ul style="list-style-type: none"> • Create data reports based on the waste characteristics <ul style="list-style-type: none"> ○ Refer to Appendix 5 for a sample data report created for Boston by a private waste consulting company • Based on data analysis, customize recommendations for the town that will achieve the following: <ul style="list-style-type: none"> ○ Improve existing recycling programs ○ Encourage waste reduction ○ Propose additional recycling streams ○ Look for opportunities for new recommendations to implement

Textiles Detailed Implementation Plan

Phase	Strategies
I Program Design (Month 1)	<ol style="list-style-type: none"> 1. Introductory Meetings <ul style="list-style-type: none"> • Introduce existing Sanitation Commission members • Introduce members from Wearable Collections • Introduce textile recycling program 2. Program Design Meeting <ul style="list-style-type: none"> • Identify textile recycling goals • Identify program barriers and issues • Determine rate structure • Determine funds transfer methodology • Discuss operational structure
II Pilot Program (Months 2-7)	<ol style="list-style-type: none"> 1. Operations <ul style="list-style-type: none"> • A six-month pilot program with one textile collection bin placed at the Maxwell Avenue recycling facility • Train operational staff to determine the recyclability of residents' textile materials • Monitor the amount of recycled materials and number of participants 2. Education and Outreach <ul style="list-style-type: none"> • Choose specific outreach media outlets • Promote the textile recycling opportunity • Educate residents by releasing a textile recyclable materials guideline provided by Wearable Collections
III Pilot Program Expansion (Months 8-19)	<ol style="list-style-type: none"> 1. Operations <ul style="list-style-type: none"> • Discuss with stakeholders to expand the pilot program to a year-long recycling program with five additional collection bins placed at schools, churches, and municipal office buildings where appropriate • Continuously closely monitor materials and participants at each location • Determine the capacity of Wearable Collections and Town's own staff 2. Education and Outreach <ul style="list-style-type: none"> • Based on the pilot program promotion, determine the media outlet with highest reach • Continuously promote the opportunity • Collaborate with schools and churches for increased promotion
IV Implementation (Months 20-59)	<ol style="list-style-type: none"> 1. Operations <ul style="list-style-type: none"> • Determine viability of additional collection bins • Consider with various stakeholders the practicality of voluntary-based curbside pickup program

	<ul style="list-style-type: none"> • Continuous monitoring • Continuously resolve any issue • Continuously collaborate with Wearable Collections <p>2. Communication and Outreach</p> <ul style="list-style-type: none"> • Continuously address inquiries • Continuously collaborate and communicate with all stakeholders from the community
<p>V Evaluation (Month 60)</p>	<p>1. Operations</p> <ul style="list-style-type: none"> • Determine viability of all collection bins • Determine recycling success of each bin • Determine program continuity <p>2. Communication and Outreach</p> <ul style="list-style-type: none"> • Survey satisfaction of residents, staff, and stakeholders from schools and churches

Food Waste Detailed Implementation Plan: Econservation Institute’s “Best Management Practices in Food Scraps Programs” report was used a guide for this plan.¹²

Phase	Strategies
I Program Design (Months 1-2)	<ol style="list-style-type: none"> 1. Introductory Meetings <ul style="list-style-type: none"> • Introduce existing Sanitation Commission members • Introduce stakeholders • Introduce food waste programs 2. Program Design Meetings <ul style="list-style-type: none"> • Identify food waste reduction goals • Identify program barriers and issues • Determine acceptable materials (e.g., yard waste, meat, paper) • Determine collection locations and frequency • Determine pricing structure for backyard bins and kitchen countertop bins • Determine storage location for backyard compost bins • Determine whether compostable bags will or will not be permitted • Discuss operational structure • Develop data collection and monitoring strategies • Outreach to residents to develop a volunteer group for drop-of program • Begin advance notices of programs, public outreach, education, and media campaign
II Program Launch (Months 3-6)	<ol style="list-style-type: none"> 1. Operations <ul style="list-style-type: none"> • Contract with outside partners • Purchase bins • Train sanitation, custodial, operational staff, and volunteers to understand acceptable materials • Monitor the amount of collected materials and number of participants
III Program Expansion (Month 3 and beyond)	<ol style="list-style-type: none"> 1. Communication and Outreach <ul style="list-style-type: none"> • Early in order to build enthusiasm for programs • Clear and consistent • Clear definition of what is and what is not included in food waste • Remind residents that food waste is currently in their garbage but will now simply be sorted into a different container • Mailings, social media, Town’s website, Facebook page • School programs • Make local level connections, e.g. GHG emissions, to align with Town’s sustainability goals • Identify champions who can promote the programs in the

	<p>community</p> <ul style="list-style-type: none"> • Use waste audit to highlight food waste component • Create ‘I Participate’ lawn signs that residents may display to foster a sense of community action and town pride
<p>IV Evaluation (Month 6 and beyond)</p>	<ol style="list-style-type: none"> 1. Operations <ul style="list-style-type: none"> • Determine success and viability of all programs • Determine program adjustments • Determine program expansion 2. Communication and Outreach <ul style="list-style-type: none"> • Survey satisfaction of residents, staff members, volunteers, and other stakeholders 3. Grant research for other applicable programs with high capital costs

Recycling Culture Detailed Implementation Plan

Phases	Strategies
I Short-Term (Months 1-6)	1. Planning and Implementation <ul style="list-style-type: none"> • Design and create posters and brochures aimed to educate building owners and residents about the new program • Choose a supplier for tote bags and mini bins • Begin education and promotion of the tote bags and bins for residents in multi-family homes • Develop announcements about the program for the Town’s website and social media
II Medium-Long Term (Months 6 and onward)	1. Follow-up and Maintenance <ul style="list-style-type: none"> • Distribute tote bags and small bins • Produce 30-second public service announcement segments to be aired at the farmer’s market and at the Town’s community events • Enlist enthusiastic recycling champions in each multi-family building to take a leadership role in demonstrating proper recycling practices for neighbors • Work closely with building managers and recycling champions to ensure the listed practices are on track and identify if any alterations are needed

Social Media Enhancement Detailed Implementation Plan

Phases	Strategies and Next Steps
<p>I Short-Term (Months 1-6)</p>	<p>1. Planning & Implementation</p> <ul style="list-style-type: none"> • Seek County approval to create social media pages on multiple platforms • Set communication goals • Develop information for social media platforms to make it more inclusive and user-friendly • Create Facebook, Twitter, and Instagram pages • Include social media logos on official Town of Mamaroneck and Village of Larchmont websites to make residents aware of their existence • Encourage residents to join the page by providing incentives, e.g. gift cards for the 1,000th follower
<p>II Medium-Long Term (Months 6 and onward)</p>	<p>1. Follow-up and Maintenance</p> <ul style="list-style-type: none"> • Update social media daily or weekly • Update social media sites with pickup schedules and routes • Update social media sites with brief progress reports on reaching the target of Near Zero Waste • Provide examples of zero waste success stories at local and national levels

“Oops” Sticker Implementation Plan

Phases	Strategies
I Short-Term (Months 1-6)	Introduction <ul style="list-style-type: none"> • Initiate talks with the County regarding the use of the stickers in the Town • Create and introduce Task Force members specific to the “Oops” sticker campaign • Overview of existing sticker law used by the Town, if any • Identify goals and set targets • Identify barriers • Identify means of monitoring • Discuss rate structure for the different building types: single-family homes, multi-family homes, and non-residential buildings
II Medium-Term (Months 7-10)	Program Design <ul style="list-style-type: none"> • Introduce Task Force objectives, targets, and timelines • Discuss approaches to work with multi-family homes as well as non-residential entities • Create a separate plan for each household area • Analyze existing operation routes and how the “Oops” sticker could increase time during collection by 20 seconds per stop, as indicated by SWANA • Determine enforcement policies • Tackle barriers identified in the first six months.
III Program Expansion (Months 10-11)	Outreach Planning <ul style="list-style-type: none"> • Determine public relations and media budget • Choose specific outreach media outlets • Identify key stakeholders • Create outline and implementation timeline
IV Long Term (Months 12 and beyond)	Campaign and Implementation <ul style="list-style-type: none"> • Begin education and promotion of the incentives for accurate sorting and avoiding contamination in recycling to residential as well as non-residential entities • Develop announcements about the program on the Town’s social media and website • Create a team of program maintenance, monitoring, and measurement individuals • Follow-up and maintenance

PAYT Detailed Implementation Plan:

Phases	Strategies
I PAYT Program and Design (Month 1)	<ol style="list-style-type: none"> 1. Introductory Meetings <ul style="list-style-type: none"> • Introduce Task Force members • Introduce Task Force objectives and timelines • Set future meeting schedule to introduce PAYT to residents • Provide overview of existing solid waste/recycling activity 2. Program Design Meeting <ul style="list-style-type: none"> • Identify PAYT goals • Identify legal authority and issues • Identify program barriers • Discuss decision-making process • Debate different PAYT system pros and cons • Discuss funding issues • Determine rate structure
II Program Implementation (Month 2-3)	<ol style="list-style-type: none"> 1. Stakeholder Impact Meeting <ul style="list-style-type: none"> • Discuss approach to engage multi-family housing • Discuss approach to work with local businesses • Discuss the role of fire districts • Discuss the impact of seasonal population changes • Discuss the approach to engage lower-income residents • Analyze existing operations • Create plan to work with local haulers & expand recycling services • Determine enforcement policies
III Public Education Meetings (Month 4-5)	<ul style="list-style-type: none"> • Determine public relations campaign budget • Choose specific outreach media outlets • Adopt local organization recruitment strategy • Identify key stakeholders • Determine resources necessary for campaign • Create outline and timeline
IV Implementation Logistics (Month 6)	<ul style="list-style-type: none"> • Address administrative issues • Work with retail establishments • Set up a dedicated phone hotline • Implement program maintenance, monitoring, and measurement

Appendix 5: Sample Data Report Created Through a Waste Audit

TABLE A.3 - STATISTICAL ANALYSIS OF WASTE AND RECYCLING COMPOSITION:
CHARLESTOWN SAMPLES BY NEIGHBORHOOD

Material	Refuse				Recycling			
	90% Conf. Int.				90% Conf. Int.			
	Composi- tion	Lower	Upper	Total Lbs	Composi- tion	Lower	Upper	Total Lbs
PAPER	18.2%	15.3%	21.1%	469.4	56.1%	50.7%	61.6%	857.5
1 Corrugated Cardboard	3.3%	2.2%	4.4%	85.6	22.9%	16.8%	29.0%	349.9
2 Mixed Paper	13.5%	11.3%	15.6%	347.5	23.4%	19.9%	26.9%	357.8
3 Newspaper & Inserts	1.4%	0.9%	1.9%	36.3	9.8%	7.7%	11.9%	149.8
PLASTIC	3.3%	2.8%	3.9%	86.3	7.0%	5.7%	8.3%	106.7
5 #1 PET Bottles, Containers	0.4%	0.2%	0.6%	9.9	2.8%	2.2%	3.4%	42.6
6 #2 HDPE Bottles and Jars	1.0%	0.7%	1.3%	26.4	2.0%	1.6%	2.3%	30.0
7 Tubs, Cups, Trays, & Lids	1.7%	1.3%	2.1%	44.7	2.0%	1.5%	2.4%	30.0
8 Bulky Rigid Plastics	0.2%	0.1%	0.3%	5.3	0.3%	0.0%	0.6%	4.1
Metal	1.1%	0.9%	1.4%	28.6	1.6%	1.5%	1.8%	25.2
10 Aluminum Beverage Cans	0.2%	0.1%	0.3%	5.2	0.5%	0.4%	0.5%	7.0
11 Aluminum Tins/Foil	0.4%	0.3%	0.5%	10.2	0.2%	0.0%	0.3%	2.6
12 Steel Cans	0.5%	0.4%	0.7%	13.2	1.0%	0.8%	1.2%	15.5
Glass	4.3%	3.5%	5.1%	111.1	24.8%	20.3%	29.4%	379.5
14 Glass Bottles and Jars	4.3%	3.5%	5.1%	111.1	24.8%	20.3%	29.4%	379.5
All Other Trash	73.0%	70.0%	76.1%	1,884.5	10.4%	7.9%	12.8%	158.5
15 All Other Trash	73.0%	70.0%	76.1%	1,884.5	10.4%	7.9%	12.8%	158.5
Total:	100.0%			2,579.9	100.0%			1,527.4
Total Recyclables:	27.0%			695.4	89.6%			1,368.9
Number of Samples:	12				12			

Source: City of Boston Recovery Rate Analysis. 2014.

Prepared by: DSM Environmental Services, Inc. Mid Atlantic Solid Waste Consultants

Appendix 6: Case Studies

Summary of all Case Studies referenced in this report

Geographic Area	Topic Covered	Page #
Montclair, NJ	Backyard Composting	43
Brattleboro, VT	Residential Food Waste Drop-Off	44
Hastings-on-Hudson, NY	Food Waste Collection in Schools	46
Culver City, CA, Orange County, NC	Recycling Culture in Multi-Family Homes	50
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Waste Characterization Case Study

(1) New Paltz, NY

Town Description:

The town of New Paltz is located in Ulster County, New York. At any given point, the population varies from 16,000 to 18,000.¹³ New Paltz is a unique community but similar to Mamaroneck in that it has both a village and a town. Housing is a mix of both single-family and multi-family homes.

Solid Waste Management Program:

It adopted the Climate Smart Communities pledge in 2010. Shortly thereafter, the EPA contacted the town to be a partner member in the federal level EPA Waste Wise Program, for which the town then received technical assistance. A comprehensive Zero Waste Plan recorded the actions local consumers, businesses, and government officials took to reduce the quantity of pre-stream, mid-stream, and downstream wastes created through strategies including better recycling, reuse, and conservation measures.¹⁴ A two-year waste characterization study was part of the implementation plan. Based on the findings of the waste characterization study, the town created a recycling center and a reuse drop off center. The Solid Waste Management budget for New Paltz in 2010, 2011, and 2012 was \$70,000 and in 2013, 2014, and 2015 is \$48,000.¹⁵ The town attributes the substantial decrease in expenses to better waste management practices.¹⁶

Related policies and implementation:

Both the village and the town had to sign up to be an EPA WasteWise community. Methodology included conducting monthly waste audits of their sample trash and using that data to report annual numbers. Trash bags were either individually weighed on a certified scale or were assumed to be a pre-determined average weight when weighing was not possible, as in the case of food waste. New Paltz initially hired a staff of two to help town sanitation staff and later hired one more person. The pre-study recycling rate was close to 50%, with the initial waste study focused on analyzing the remaining 50% of waste that was being sent to landfill.¹⁷ The waste study is currently in its second year with a select group of 1,000 participants. It has provided the town with the necessary benchmark data to influence recommendations, policy changes, outreach, training, and educational needs. The town's intermediate goal is to conduct a comprehensive waste audit for the total community starting in 2015 with an end goal of being a Zero Waste Community by 2018.

Financials:

The main cost incurred was on personnel. The recommendations from the waste study were not too technical to implement nor expensive to build and maintain. The strategy that worked for the town and simultaneously generated substantial revenue was through pulling out reusable materials from the trash and reselling it, such as composting the food waste to sell to fertilizer companies. Thus, the town discovered improving their waste management practices generated income in the long run.

PAYT Case Study

(1) Southold, NY

Town Description

The Town of Southold is located in Suffolk County, New York, on the North Fork of Long Island. According to the U.S. Census Bureau, Southold has a population of 21,968 with a population density of 408 people per square mile and a median age of 48 years old.¹⁸ In 2009 there were 14,933 total housing units of which 8,890 were occupied. Of the 8,890 homes that were occupied, roughly 80% were owner-occupied. Housing units consist primarily of single-family homes at roughly 90%.¹⁹ Household median income for 2009 was \$66,464 and per capita income was \$36,383.²⁰ In 2013, the Town spent \$4,446,776 on its Municipal Solid Waste Program.²¹

Solid Waste Management Program

Southold established a mandatory PAYT solid waste management program in 1993. The town established this program to pay for the transport and out-of-town disposal of solid waste following the enactment of the New York State Landfill Closure Law of 1988.²² Southold uses a volume-based system for household garbage that cannot be recycled or reused. They offer three different sized, yellow bags: 15-gallon at \$0.75, 33-gallon at \$1.50, and 56-gallon at \$2.25. The bags are sold at a vending machine located in the transfer station, 28 retailers at a 10% discount, and in the town hall.⁵

Southold does not provide curbside pickup. It owns and operates a single transfer station where all residents and contracted private haulers can dispose of their solid waste, yard waste, and recyclables. Recyclables include paper, cardboard, glass, plastics #1-7, aluminum, tin, used oil, tires, batteries, empty aerosol cans, empty paint cans, textiles, scrap metal, yard waste, and home appliances.²³ Since the majority of local businesses are restaurants and vineyards, from operational efficiency perspective, they already have the incentive to minimize waste, so they do not participate in the program. All recyclables, home appliances, and yard waste can be dropped off for free at the town transfer station. In addition, Southold offers fall and spring yard waste pickup.²⁴ Food waste is not recycled and is considered part of bagged disposal.²⁵

All residential trash that cannot be bagged, commercial waste, and construction and demolition debris are charged a tipping fee based on the type and weight of the debris. All residents, visiting non-residents, and businesses holding a valid business license issued by Suffolk County must obtain a permit to dispose of this bulk waste.²⁶

Over the first sixteen years of the program, Southold has maintained a 55% diversion rate.²⁷ Immediately following implementation, it realized a 29% reduction in household garbage delivered to transfer station, a 43% increase in household recyclables between 1990 and 1992, and a 75% increase from 1992 to 1994.²⁸

Policies

Southold's PAYT, municipal solid waste program is a town-wide, mandatory program that was enacted according to municipal legislation. The approach to recycling and reducing waste is regulatory. The municipal waste district maintains a zero-tolerance policy regarding non-compostable debris being dumped at the compost site. These contaminated compost loads are charged at the full rubbish rate. Cameras are used to monitor and record all transactions to ensure proper compliance.²⁹

(2) Natick, MA

Town Description

The town of Natick, Massachusetts, holds a population of approximately 33,000 residents with a median household income of \$95,000.³⁰ Its residential structure consists of approximately 33% living in multi-family buildings and 67% in single-family homes.³¹ The town has a recycling committee whose mission is to encourage dialogue about alternatives for current programs as well as to advocate recycling-related activities in agreement with the Department of Public Works.

Solid Waste Management Program

The town utilizes a PAYT waste system, which has been in effect since July 2003. The program was implemented after a town vote and extensive public discourse.^{32,33} With the PAYT program, residents are required to put their household trash into designated PAYT blue trash bags in order for it to be collected by the Public Works Department. The bags are sold in packs of ten, are priced at \$1.75 for a 33-gallon bag and \$1.00 for a 15-gallon bag, and are sold at a variety of general goods store and supermarkets such as Roche Bros., Jones Drug Inc., and Honey Farms. The waste that is collected is sent to the Millbury Waste-to-Energy Facility.³⁴

Paper/Plastics Recycling

Natick's recycling program provides single-stream curbside pickup for all residents, meaning that all paper, plastic, glass, and metal materials can be commingled in a single bin. Residents are given one free bin per household, and any additional bins may be purchased at \$7.50 each. As an alternative, the town also has recycling stickers that are available at no charge and can be placed on crates or other equivalent recycling collection containers. Natick took control of the curbside recycling program from a private hauler in August 2013. With the takeover, residents were given new 96-gallon recycling containers that came equipped with two wheels for easy transport. Curbside recyclables are picked up every other week from households.³⁵

The town also operates a recycling center that is open year-round where residents can come to dispose of their yard waste in the composting area. The recycling center has been in operation since 1995 and is open to both residents and businesses. Aside from yard waste, residents and businesses can come to drop off old batteries, light bulbs, Styrofoam, motor oil, and paint. Both the center and

the Public Works Department do not accept hazardous waste nor any construction and demolition materials.³⁶

Composting

Compost collection is not provided aside from the drop-off option given to residents for their yard waste. However, the town encourages backyard composting among its residents. Home compost bins are available for sale, and townspeople can pick up free compost from the recycling center.³⁷ For the yard waste collected, the waste must be put into paper biodegradable bags or durable bins marked as Yard Waste. Any yard waste that is put in plastic bags will not get collected.³⁸ Natick does not currently operate nor contract for any cooking oil or grease collection.

Finance and Budget

In 2013, the town spent an estimated \$3.2 million for its solid waste management services.³⁹ Natick's Department of Public Works has a preliminary 2014 fiscal budget of roughly \$7.1 million, \$2.8 million of which is allocated to the Division of Highway, Sanitation, and Recycling.⁴⁰ Since the program's implementation, the town of Natick has seen continual reduction in its annual expense for waste services; from 2011 to 2012, annual expenses fell nearly \$340,000. Tipping fees for solid waste have risen year to year, yet the amount of solid waste that is collected has correspondingly fallen year to year as well. In 2013, tipping fees totaled nearly \$562,000, and expenses for the curbside recycling programs topped \$25,000.⁴¹

(3) Gloucester, MA

Town Description

The City of Gloucester (CoG), Massachusetts, has a population of 28,789 residents. The CoG provides residential curbside trash and recyclable collection for 13,000 households.⁴²

Solid Waste Management Program

The CoG implemented a PAYT program utilizing a bin system with a sticker attached to it starting in 1990. The program was prone to abuse resulting from damaged stickers and problems with enforcement by trash haulers. As a result, the program did not significantly improve the city's recycling rate. The CoG switched to a PAYT two-bag system with the help of the non-profit WasteZero, Inc., in 2009. In this system, the CoG pays a fixed cost to its private trash hauler to collect trash and recycling and transport it to the transfer stations on a weekly basis. The CoG pays a variable tipping fee, per ton of solid waste that is disposed at the RESCO incinerator in Saugus, MA.⁴³

The program is financed through the sale of the bags to residents. Residents can purchase 15-gallon bags at \$1.00 each and 36-gallon bags at \$2.00 each. The bags are sold at the WasteZero retail store in town as well as at 20 local retail outlets.⁴⁴

The city realized a 37% reduction in trash volume after the first month of implementation. After the first year, the CoG was able to reduce its solid waste tonnage by 26% or 2,373 tons, resulting in \$163,000 in avoided tipping fees. Through 2011, solid waste has been reduced by more than 2,000 tons with an annual savings of close to \$140,000 each year.⁴⁵

Food Waste Case Study

(1) Franklin County, MA

Town Description

Franklin County in western Massachusetts is a growing leader in commercial composting. The County is comprised of 22 member towns, and its Solid Waste district (FCSWMD) provides a list of services that include tracking and reports, grant writing, and special programs operation. The FCSWMD manages organics drop-off programs in four of its member towns, serving a total population of roughly 13,000 residents.⁴⁶

Each town accepts food scraps and soiled paper as part of its organics program, and the waste is collected at each respective town transfer station. The two biggest programs, based on population served, were in the towns of Northfield, Massachusetts, and Orange, Massachusetts.⁴⁷

Solid Waste Management Program

In Northfield, food waste was collected in an industrial organics dumpster and emptied out weekly by the designated hauler, Triple T Trucking. The organics were hauled to Martin's Farm in Greenfield, Massachusetts for composting. The town was charged a flat rate for the organics collection. Within one year, Northfield reported already saving a total \$2,760 in avoided disposal costs from tipping and hauling fees.⁴⁸

Outreach for the program was done through press releases, handouts, and presentations held at the schools. The district also provided signage around the transfer stations so residents could be informed of what could and could not be composted. The programs have had much success per the remarks of the FCSWMD Program Director, Amy Donovan.⁴⁹

In Orange, the town used three 20-gallon barrels for collection. These barrels were emptied out weekly by the designated hauler Clear View Composting. The organics collected could then be hauled to Clear View's own composting site in town.

Since the program began in May 2011, Orange has composted an estimated 4 tons of organic food waste; and Northfield currently composts an estimated 36 tons of food waste per year.⁵⁰

Appendix 7: Assessment of Feasibility of Single-Stream Recycling

Introduction

While Mamaroneck's current system of source-separated recycling is an effective method of collection, single-stream recycling has proven to be far more effective at increasing the recycling rate.⁵¹ Single-stream, or fully commingled recycling, is a system in which all paper fibers and containers are collected in the same bin rather than being sorted into separate bins based on material, such as paper products, plastics, or glass. A study conducted by the EPA states that communities with high diversion rates are more than twice as likely to have programs like single-stream where paper, plastics, and other materials are recycled collectively. They are also known to include corrugated cardboard, magazines, plastics, glass, and phonebooks.⁵²

Southold, New York, recently implemented single-stream recycling. Under this system all recyclables collected were mixed together but with a separate pickup for garbage. New, highly efficient sorting technology at recycling centers makes this possible by separating the recyclables to their different categories onsite. Recycling becomes easier for residents and items that were previously too difficult to sort from the waste are often added to the recycling mix, thereby increasing recycling rates and reducing disposal costs.⁵³ It is also worth noting that almost 60 percent of the world's zero waste towns and cities have reached their respective diversion rates by implementing single-stream waste collections, suggesting strong improvements with the implementation of the system.⁵⁴

Strategy overview

In 2005, 20% of recycling communities in the U.S. used single-stream recycling, but by 2010, that figure grew to 64%. At the same time, communities using multi-stream recycling decreased by a similar amount, from 70% to 34% over the same period.⁵⁵ Transitioning to single-stream has several advantages including a decrease in total collection and hauling costs and increases in route efficiencies. It has the potential to increase total materials collected and could therefore increase recycling rates in town and make greater progress in achieving Near Zero Waste. Furthermore, the material preparation and handling for each resident will be much easier and convenient avoiding confusion of placing items in incorrect bins or bags for collection.

Finances

Single-stream collection also lowers collection costs, therefore costs to the council and town. The Solid Waste Association of North America (SWANA) stated that in a fully automated single-stream system, the average stop time was 26 seconds. With an assumed time of 12 seconds between stops, the collector is able to service 171 households per hour.

SWANA compared this time to two different dual-stream systems; the first had a two-bin system with a stop time of 36 seconds, allowing 130 households to be serviced per hour, and the other had a one-bin system with a stop time of 61 seconds, allowing only 82 households to be serviced per hour. Therefore resulting in reduction of transport time and labor.⁵⁶ The two cart options are 65-

gallon or 95-gallon, each costing \$5 per month or \$8 per month per cart respectively and each having wheels and a lid.⁵⁷

Single-stream collection systems reduce collection costs and lower worker injury rates. The higher capital costs can be more than offset by system efficiencies and reduced operations costs. Depending on tonnages and commodity values, a town could realize up to \$40 per ton of net cost savings.

Challenges

- **Rollout Cart Concerns:** There may be concerns about the size of the recycling cart and storage of the cart.
- **Employee Training:** Re-routing the entire Town's collection route means that all employees would be working on new routes. Employees will have to receive extensive training to re-learn territories and the new established collection patterns.
- **New Technology:** RFID chips will be embedded in the new recycling carts. Some concerns about privacy have surfaced. SWANA had to plan and develop strategies for using the unfamiliar technology even when data collection was imperfect, e.g. malfunctioning readers on collection vehicles. These chips have helped cities track and manage cart inventory and maintenance expenses, monitor driver performance and recycling participation rates, and better focus recycling and environmental education.

Single-Stream Case Studies

(1) Madison, WI

The City of Madison, Wisconsin, began single-stream recycling with automated collection in September 2005, following two years of planning. A study conducted by The Chippewa County Facility indicated that the time was right for this change, since recycling trucks needed to be replaced, the transfer station needed redesign, and the recycling contract was up for renewal. Despite a significant upfront capital cost, political support was strong to develop additional capacity due to population growth projections and a history of high recycling rates. 2006 was the first full year of implementation of the new recycling program, and Madison saw a 25% increase in overall recycling compared to 2005 levels. Additionally, the City achieved over \$103,000 in landfill tipping fees savings in 2006 as compared to 2005.⁵⁸

(2) Bedford, NY

The Bedford Town Board approved legislation for single-stream recycling in 2013. Bedford now has single-stream recycling paired with its PAYT program in place and hopes to achieve a 40% recycling rate by 2020 compared to its baseline figure of 17%.⁵⁹

Appendix 8: Food Waste Diversion Options Researched But Not Recommended at This Time

Food waste collection programs are on the rise in the U.S., as communities understand the negative impacts that food has on the waste stream and the environment. These include hauling costs and tipping fees for food waste and methane emissions produced by rotting food in landfills. Diverting food from the waste stream will create cleaner sanitation facilities, reduce the total volume of municipal solid waste, decrease hauling and tipping fees, and, if the food waste is composted, create a by-product that can be used as a soil amendment.⁶⁰ Programs include using drop-off locations to gather food waste, partnerships with pig farmers who collect food waste scraps for use on their farms, school food waste collection programs, commercial collection, and onsite in-vessel composting systems. An estimated 50% increase in residential curbside collection programs has occurred across the United States since 2009.⁶¹ In 2009, 91% of programs surveyed by the Econservation Institute reported that their programs were voluntary, but for some cities, like San Francisco and Seattle, it is required by law.⁶²

The table below indicates the various food waste collection programs researched for Mamaroneck, with waste reduction impact, cost and feasibility for each program.

Food Waste Management Options^{63,64}

Options	Targeted Buildings	Annual Waste Impact (tons)	Cost (5 years)	Implementation Timeline	Feasibility
Backyard Composting	Single-Family, Multi-Family	7.25	\$589	3 months	High
Drop-Off Locations	Single-Family, Multi-Family, Non-Residential	231	(\$112,716)	3-6 months	High
School Program (Non-Residential)	Non-Residential	117	(\$178,652)	Requires Superintendent approval	High
Curbside Collection (Residential)	Single-Family, Multi-Family	495	(\$2,701,074)	-	Low
Curbside Collection (Non-Residential)	Non-Residential	312	(\$73,874)	-	Low
Onsite, In-Vessel Composter	Single-Family, Multi-Family, Non-Residential	Nath Solutions Hot Rot 3518 = 4,200 tons/ year; FOR Solutions = 1,400 tons/year	Nath Solutions Hot Rot 3518 = \$1.6 million start-up; FOR Solutions = \$375,000	1-3 years	Low: Need to secure funding through grants. Possible sources include WC, NYS DEP.

Option 1 – Curbside Collection Pilot Program

A pilot program for curbside collection of food waste for Mamaroneck residents and non-residential buildings could provide the Commission with data and operational information to evaluate the viability of providing this service to the entire Town.

In order to undertake the pilot, the Town would need to evaluate its own trucks and personnel to determine if it will be possible to use their own equipment and people to operate the program. The pilot program would need to be designed for a neighborhood chosen to provide the best data for evaluation of a Town-wide service. Other factors would also need to be considered, including the types of bins provided to residents, collection frequency, and specific materials accepted.

The initial financial cost could vary greatly depending on how the pilot is implemented. If it is possible to use existing sanitation equipment and personnel, the cost may be limited. If a private hauler is hired, the cost may be similar to existing or slightly higher, depending on the contract.

Outreach would be necessary to achieve a high participation rate and could be similar to the communication strategies developed for the recommendations. The community outreach can also include advice on how to reduce food waste, from smart shopping to how to properly store fruits and vegetables so that they last longer.

There are different challenges that make this not an ideal program for the Town at this time. One is participation. Some residents may not want to participate because they already have a backyard composting system that produces compost for their own use and other residents may be reluctant to have food scraps in their kitchen waiting for the pickup day. There is an “ick” factor when people do not understand how the program will work. Composting is growing in popularity and acceptance but still has people who are resistant to the idea. Behavior change will be a major factor in the success of this program, beginning with not putting food down the disposer or trash bin and ending with putting the saved food waste into a different bin for pickup.

Option 2 – In-Vessel Composting System

An in-vessel composting system could allow Mamaroneck to process its food and yard waste and provide it with a usable by-product that can be used on its grounds. In these systems, “composting is conducted within a fully enclosed chamber.”⁶⁵ Organic materials are fed into a drum, silo, concrete-lined trench, or similar equipment, and the composters vary in size and capacity. Some can fit into a school or restaurant kitchen, while others can be as large as a school bus.⁶⁶ The size and capacity variations range from hundreds of gallons to thousands of tons per day, while the price can vary from tens of thousands to over a million dollars.

The capital cost of this program will vary greatly depending on the size of the system. Outside funding from county, state, or federal grants or through pilot programs could reduce the finances required from Mamaroneck to make an in-vessel compost system a viable option in the near future.

There could be many benefits to an in-vessel system for Mamaroneck, such as reduced weight of trash and associated tipping fees, and reduced GHG emissions. The in-vessel composting system could enable the Town to process both its food waste and yard waste without assistance from the County while simultaneously producing a valuable by-product. It also requires less space and manpower than a curbside collection approach, is not weather-dependent, and eliminates stormwater runoff and water supply contamination.^{67,68} The compost material could be used on the Town's properties and could reduce the amount of soil amendments purchased each year. The system could also be used for educational purposes in schools. An in-vessel system could provide Mamaroneck with a permanent location to process its food and yard waste and could eliminate the need to secure a facility that would continue to accept the Town's food waste.

Appendix 9: Benchmarking Criteria

The table below provides the full list of considered criteria that was researched to inform the understanding of best practices regarding solid waste management.

Content Outline

- I. General Information for Each City/Town
 - i. Population
 - ii. Population density
 - iii. Land Area in square miles
 - iv. Median Income
 - v. Housing Type – Single-family vs. Multi-family
 - vi. Total Waste Disposal Budget
 - vii. Funding Source
 - viii. Laws/Policies in Place Around Waste Disposal
 - ix. Percentage of Solid Waste Diverted from Landfill
 - x. Total Tons of Waste Generated Each Year

- II. Best Practices Around Residential Waste
 - i. Who collects the waste?
 - ii. How is the waste collected?
 - iii. Current practice for general waste
 - iv. Current practice for organic/food waste
 - v. Current practice for curbside commingled containers and mixed paper
 - vi. Current practice for yard waste
 - vii. Current practice for bulk items
 - viii. Current practice for electronic waste
 - ix. Current practice for cooking oils/grease waste
 - x. Current practice for C&D (construction and demolition) waste
 - xi. Communication strategy
 - xii. Incentives or Penalties in Place

- III. Best Practices Around Commercial Waste
 - i. Who collects the waste?
 - ii. How is the waste collected?
 - iii. Current practice for general waste
 - iv. Current practice for organic/food waste
 - v. Current practice for curbside commingled containers and mixed paper

- vi. Current practice for yard waste
- vii. Current practice for bulk items
- viii. Current practice for electronic waste
- ix. Current practice for cooking oils/grease waste
- x. Current practice for C&D (construction and demolition) waste
- xi. Communication strategy
- xii. Incentives or Penalties in Place

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