Memorandum
Department of Environmental Facilities

George Latimer
County Executive

Vincent Kopicki, P.E.
Commissioner

DATE: January 27, 2020

TO: Hon. George Latimer, County Executive

CC: Joan McDonald, Director of Operations
Peter McCartt, Director of Sustainability
Aviva Meyer, Assistant to the County Executive, Public Health & Infrastructure

FROM: Vincent F. Kopicki, P.E., Commissioner
Louis J. Vetrone, Esq., Deputy Commissioner
Melissa-Jean Rotini, Esq., Director of Environmental Management Operations

RE: **Food Waste Study: Report and Initiatives**

The Food Waste Study commissioned by the County has been completed. The scope of the project included a review of applicable technologies, and sought recommendations as to which technologies would best suit the needs of the County, its municipalities, residents, and environmental goals. The resultant report, completed by Woodard & Curran, made mid-term recommendations for handling food waste. The mid-term recommendations are for co-digestion of food waste at an existing County water recovery facility, and/or a small-scale anaerobic digester co-located at the Wheelabrator facility in Peekskill. The long-term recommendation is for a dedicated anaerobic digester facility to be located within the County, likely achieved through a public-private partnership.

As the Report focused primarily on mid and long-term solutions, DEF has developed and recommends the following immediate and short-term proposals.

Additionally, the County established a Food Scrap Work Group with community stakeholders to develop short-term proposals for municipal food scrap handling. The Work Group proposed a pilot program to determine the feasibility of accepting municipally collected food scraps at the Yonkers Transfer Station. That pilot program is currently being established.

DEF Food Scrap Delivery and Transportation Program

In an effort to allow all Refuse Disposal District #1 municipalities to participate in food scrap recycling, irrespective of budgetary constraints of the municipality, DEF proposes the County initiate a Food Scrap Delivery and Transportation Program ("FSDTP") with a private hauler. Under FSDTP, the County would issue a request for proposals for a licensed carting company to provide: (1) pick-up of source-separated food scraps collected at municipal drop-off programs; (2)

a facility where municipal food scraps can be consolidated and where municipalities operating curbside collection programs can deliver food scraps; and (3) transport of consolidated municipal food scraps to a food waste recycling facility.

The FSDTP would allow District municipalities to initiate food scrap collection programs, continue existing programs, and expand and enhance programs as their need, budget, and staffing permits. It is anticipated that the County would be able to offer the program to participating municipalities at a subsidized rate similar to the current solid waste disposal fee ($29.28/ton), which would result in a considerable savings for the municipalities.

District municipalities would have the option to enter into an IMA to participate in the FSDTP, which would be a voluntary program. To expedite the start of the contract and to further reduce costs for District municipalities, DEF would make available to the winning bidder a specialized 75 cubic yard tractor-trailer to prevent leaking during transport of the food scraps. The loads being delivered to composting facilities would be consolidated to minimize greenhouse gas (GHG) emissions. It is anticipated that only 1-2 trips per week would be necessary to transport the food scraps from existing municipal programs to an organics recycler.

DEF believes that the FSDTP could be established and operational in approximately six months.

DEF Compost Site and Education Center

As indicated in the Report, composting is best able to be used in-County on a local scale. Many municipalities have department of public works yards with adequate space for composting the food scraps produced within their borders. Local processing of the food scraps collected would reduce GHG emissions created by transporting food scraps to commercial composting facilities. Additionally, backyard composting is also possible in many areas of the County.

The establishment of a small-scale Compost Site and Education Center ("CSEC") would allow residents and District municipalities to learn about the benefits of composting, including the GHG emission savings when composting is local, and how to incorporate food scraps into existing yard waste composting programs. As an active small-scale composting site, residents and District municipalities could observe the methods, space requirements, and various levels of equipment that can be used in composting. The CSEC would help to make local municipal and at-home composting accessible to municipalities and residents.

DEF believes that the CSEC could be established and operational within 12-15 months.

Under both the FSDTP and CSEC, DEF Recycling Office staff would provide a fact sheet and support for municipalities in applying for State Grant Matching Funds to offset the cost of the items necessary for District municipalities to establish drop-off food scrap collection and/or composting programs.

FOOD WASTE STUDY REPORT

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Woodard & Curran Engineering P.A. P.C.
COMMITMENT & INTEGRITY DRIVE RESULTS

214642.00
Westchester County
January 21, 2020

214642.00

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EXECUTIVE SUMMARY

In 2018 the County moved forward with a Study to preliminarily assess key factors that impact the overall feasibility of a food waste diversion program and recycling facilities within the County, with an initial focus on large commercial food waste generators. A Report prepared by Woodard & Curran was issued in March 2018, which considered factors impacting the feasibility of a food waste diversion and recycling program, including whether or not there would be enough food waste available and recovered to support the operation of an in-County recycling facility(ies) along with other related factors. Preliminary estimates of food waste quantities generated in the County for the commercial and residential sectors were developed primarily using published information. The Study also provided recommendations for future steps to move towards the implementation of a formal County wide food waste diversion and recycling program. Recommendations included supplemental studies to better define food waste processing and recycling options, consider facility siting opportunities, refine food waste quantity estimates and develop an overall implementation strategy. Refining estimates would be accomplished by using industry accepted estimating tools and actual data through surveys of large commercial waste generators. Conclusions drawn from the March 2018 Study indicate that there is a sufficient amount of food waste generated and available at the commercial and residential levels and it made sense to move ahead with more detailed studies and future planning efforts.

The recommendations for future next steps in regard to planning included in the March 2018 Report were used as the basis for this follow up study that the County authorized earlier this year.

This Study Report will provide updated information regarding food waste estimates and current food waste management practices in Westchester County as well as short and mid to long-term recommendations for the processing and recycling of food waste in the County. Given the April 2019 legislation that was passed in New York State, the Food Donation and Food Scraps Recycling Act, there will be a growing need for food waste recycling facilities in the County. This Act (effective January 2022) will require that large commercial food waste generators (i.e. generating more than 2 tons/week) separate edible and inedible food, and divert inedible food waste to a recycling facility, provided there is a facility within a 25-mile radius. The large commercial waste generators have between now and January 2022 to prepare and have the infrastructure in place to separate, store and haul out food for donation and recycling/processing. There will also continue to be a growing need for a food waste recycling facility(ies) in the County to accommodate the growing recycling programs in the residential sector, both for voluntary drop off and curb side collection programs.

It should be noted that this Study is intended to address the management of the food waste stream as a whole within the County. In the solid waste management industry food waste is a broad term which, by definition, includes food waste or loss that occurs at the stages of producing, processing, retailing and consuming. Food scraps typically implies the food materials that are discarded following preparation or consumption, i.e. what remains. Where appropriate, the term food scraps is used in this Report as well to specifically address food discarded following preparation or consumption. The term food waste includes food scraps.

Specifically, this Report will provide information on:

- Food waste quantity estimation and analysis for the commercial sector in Westchester County utilizing estimating tools that are widely accepted and used in the food waste recycling industry, including by the New York Department of Environmental Conservation (NYSDEC).
- Food waste quantity estimates using statistical and per capita analysis for the residential sector in Westchester County.
- Overview of available food waste processing and recycling technology options available to the County including composting, Anaerobic Digestion (AD), Hybrid AD/composting, and Water Resource Recovery Facility (WRRF) co-digestion.

- Summary of current food waste management practices by commercial and residential food waste generators in Westchester County, including donor programs, residential voluntary drop-off and curb side collection practices, as well as an estimate of current processing capacity.
- Recommended solutions for food waste processing in Westchester County, including preliminary estimates on the implementation costs, and implementation schedule.
- Summary of important permitting and regulatory considerations in the development of a food waste processing facility.
- Potential interim measures until a facility(ies) is operational in the County, and funding opportunities for the County.
- Summary of community input throughout the development of the Report.

An interim solution is included in this Report consisting of the weekly delivery of food scraps from the residential sector to one of the County's municipal solid waste transfer stations. Once loaded into a transfer vehicle the food scraps would be delivered to the Ulster County Resource Recovery Agency (UCRRA) facility in Ulster County, New York, or another suitable location for composting. This solution assumes that food scraps received from the residential sector have been collected at individual municipalities through either voluntary drop-off programs and/or curbside collection. It is estimated that this interim solution could be implemented in approximately 12 to 18 months.

A mid-term solution for the processing of up to 10,000 ton/year of food waste was identified as part of this Study. This solution consists of co-locating a food waste processing facility adjacent to the County owned Water Resource Recovery Facility (WRRF) in Peekskill, New York. The co-digestion process would involve processing food waste into a slurry and feeding the slurry into the WRRF digester. The County owns and operates seven (7) WRRFs. However, only two (2) facilities utilize AD (Yonkers Joint WRRF and the Peekskill WRRF). Based on discussions with the County and further evaluation, the Peekskill WRRF is a more viable option, as it was found to have available capacity for the digestion of food waste slurry and sufficient space to incorporate additional equipment necessary for food waste. We estimate that the Peekskill WRRF would be able to process approximately 10,000 tons of food waste per year with minor retrofits. The cost of this solution is estimated to be in the range of $6M to $8M, depending on the scope of the retrofits ultimately needed at the existing WRRF which would be more specifically defined as part of a separate facility evaluation study. It is also estimated that the necessary retrofits could be implemented in approximately 3 years, including permitting.

A second potential mid-term solution includes the co-location of a food waste processing facility at Wheelabrator's Waste to Energy (WTE) facility, also located in Peekskill, NY. There is the potential opportunity to locate a food waste processing facility with anaerobic digestion on the limited area that is available. Given there is about 0.75 acre available on site, the size of the food waste facility would be limited to about 10,000 ton/year. The cost of this facility is estimated to be about $5M to $7M. It is also estimated that it could be permitted, built and operational in approximately 3 years.

A longer term solution consisting of AD was also identified as part of this Study. The AD could possibly be located at the County-owned site known as the "Water Tower Site" located East of the Westchester Medical Center (across from the Sprain Brook Parkway) in Valhalla, New York (Town of Mount Pleasant). The intricate topography at the site requires significant sitework to accommodate any type of facility, but the sitework is minimized for AD given the need for a smaller footprint than composting. A complete food waste processing and anaerobic digester operation could be implemented on 3 to 4 acres at this location to accommodate approximately 60,0000 ton/year of food waste processing, and it is estimated to cost in the range of $25M - $30M. It is also estimated that this solution could be implemented in approximately 4 years, including permitting. This facility could be designed with future expansion opportunities to increase the future processing capacity to 80,000 ton/year or more, depending on the success of food waste recycling within the County.

As part of this Study, potential short term solutions were suggested at Stakeholder meetings, including small "micro" type anaerobic digesters for individual municipalities and also smaller scale compost facilities for individual municipalities. As addressed in this Report, the challenges with these options include potential excessive operation and maintenance costs, lack of land availability, limited locations for candidate compost sites, and sensitive receptors. These challenges make these suggested short-term solutions less feasible to be implemented as a County-wide solution. However, individual municipalities in Westchester County may decide to undertake their own food waste recycling programs.

Currently in Westchester County, it is estimated, based on our analysis, that approximately 103,000 tons of food waste are disposed annually by the commercial sector, while the residential sector is estimated to dispose of approximately 85,000 tons of food waste per year. However, this amount is not expected to be captured in full or instantly. There are a number of factors affecting the capture rate including public policy and infrastructure limitations. Typically, capture rates for food waste can range from 10% to as much as 40%, with the high end of the range achieved over an extended period of time. As an example, in Utica NY the food waste co-digestion facility has a capacity of 22,000 ton/year and in year one received 2,000 tons. They estimate by year 5 they will receive 5,000 tons.

The amount of estimated disposal quantities and potentially available for recycling are further reduced through enhanced food waste donation and diversion programs. Based on our analysis, food rescue potential was estimated to be less than 10,000 ton/year. Another effective way to reduce food waste from the disposal stream is through education programs and community outreach targeted to reduce food waste at the source i.e. where it is generated.

A detailed analysis of various food waste processing and recycling technologies was completed to identify pros and cons for each technology. In summary, given the scarcity of County owned property available for developing a food waste processing/recycling facility, and the cost to acquire sufficient acreage to accommodate a facility, densely populated areas in the County, along with the challenge of siting a new facility in an area where there would be minimal impacts to the public and sensitive environmental receptors, anaerobic digestion ("AD") and co-digestion were identified as the more likely technologies/facility types that could be implemented in a reasonable time frame and have more of an immediate positive impact on food waste recycling in the County.

Strategically, having a facility or multiple facilities located in the northern part of the County such as the ones identified in the Study for Peekskill, will allow the County to offer recycling facilities as soon as 2022. Since these facilities will likely not be operational in time for the January 2022 date when the large commercial generators would need to start delivering their food waste to recycling facilities within a 25-mile radius, in the interim, the commercial businesses and institutions may obtain a waiver until such facilities are available and/or could transport their food waste out of County. While the process isn't completely defined at the State level, large commercial food waste generators who decide not to deliver food waste to a food waste recycling facility because there is not a facility located within a 25 mile radius of the commercial establishment, would still need to request a waiver from New York State. Presumably the waiver would apply until a facility was constructed and in operation within the State required 25-mile radius, similar to the State of Connecticut. Although the process is not completely defined, it is understood that the State enforcement division could decide to conduct an audit at any time.

We do note that a future larger facility at the Water Tower Site in Valhalla could accommodate a wider service area, representing an outlet for communities in the southern, middle and northern parts of the County.

While locating sufficient acreage and an acceptable candidate site to accommodate a composting facility (open windrow, indoor mass bed etc.) is a significant challenge in Westchester County, as part of the due diligence completed for this Study, there is interest by certain vendors to develop and operate a composting facility in the County, with their biggest challenges being the need for property acquisition and the size of property needed, the large scale facility they will require in order for the project to be financially feasible, and the need for a carbon source (typically co mixing with yard waste). The only known open windrow composting facility site that is permitted in the County is in the Town of

Cortlandt Manor, however, the facility has very limited capacity at 5,000 cubic yards of food waste per year (i.e. less than 4,000 ton/year). It is suggested that the County continue to maintain dialogue with vendors of composting facilities, since a possible large property acquisition in the future (20 to 25 acres) by a private vendor could result in a compost facility with a sizeable capacity (i.e. 75,000 ton/year of food waste or more). It should be noted that the use of parkland for a non-park purpose such as landfilling and/or composting is not acceptable per New York State regulations[1].

Permitting and regulatory compliance are expected to be the critical path in the schedule for any of the potential solutions, which can also have an impact on the overall implementation schedule. Final permitting needs will ultimately depend on the technology and implementation strategies chosen.

There are a number of funding programs available at the federal and state level for the development of food waste recovery facilities. The final project scope will ultimately determine the optimal funding options, which can be in the form of grants or financing. Funding amounts, timeframes and agreements vary among the various funding programs (refer to *Section 11 – Funding Opportunities*).

Community involvement was critical for the development of this Study. Stakeholder meetings and a public forum were conducted to present progress on this Report and acquire input from the public. Based on the Public Forum held at the Westchester County Center on May 29, 2019 there were some common themes noted which could be grouped and summarized as follows:

1. A need for community outreach and educational programs on food waste reduction and recycling.
2. An interest in expanding food waste recycling in the residential sector both through curb side collection and voluntary drop-off.
3. A strong interest in an environmentally friendly solutions that takes net carbon footprint reduction into account.
4. Support to keep food waste recycling local/in County to the maximum extent possible.
5. Importance of looking closely at technology options and benefits.

Within this Report (*Section 12 – Community Engagement)*, a summary is included of comments received from the public and stakeholders, as well as section(s) in the Report where specific concerns have been addressed.

Following final issuance of this Report, the next steps toward the implementation of the recommended solutions include:

1. A feasibility analysis, including a detailed engineering and financial evaluation of the existing Peekskill WRRF including the condition of all equipment, original design basis and concept design for necessary retrofits to the WRRF.
2. Detailed site development, design and cost analysis for co-location of food waste processing at the Peekskill WRRF and the Wheelabrator WTE locations, including connections to the WRRF and related appurtenances (equalization tank, piping etc.).
3. Development of a Request for Proposal, incorporating the designs developed, for a vendor/developer to provide a cost proposal and qualifications/experience to build and operate the facility. Depending on the County's preferred approach, the RFP would be for a single facility presumably at the Peekskill WRRF site, or two facilities, one at the WRRF and the other at the Wheelabrator WTE location. However, it should be noted that County involvement in the development of Wheelabrator WTE site may be limited due to the lease agreement between the County, the Westchester Industrial Development Agency ("IDA"), the Peekskill IDA

[1] NYS Parks, Recreation, and Historic Preservation Handbook on the Alienation and Conversion of Municipal Parkland (Revised September 1, 2017).

and Wheelabrator. Also, an RFP could be prepared to invite proposals from developers that may have access to alternative sites not contemplated in this Study.

4. Concurrently with development of the concept designs and RFP, a detailed site analysis would be completed, and a concept design and cost estimates for the County owned property in Mt. Pleasant would be prepared including subsurface characterization, site grading and steep slopes analysis, assessment of environmental impacts, including stormwater management, and updated property utility surveys and traffic analysis.
5. Continued dialogue is suggested with interested vendors in composting in Westchester County and providing support as appropriate, for them to identify candidate sites for acquisition/purchase. Given the need for a carbon source, the vendor may also need County support with the availability of yard waste that is currently collected and disposed of by a contracted hauling company.
6. The County should also continue to revisit their inventory of available County property for future development.
7. Upon selection by the County of food waste management option(s), the County should consider moving forward with a formal food waste community outreach program to promote food waste recycling in the County by the commercial and residential sectors and educating the community on the benefits of food waste rescue and recycling and the implementation of food waste reduction programs.

The main goals and findings of this Study may be summarized as follows:

GOAL	FINDINGS
Estimate disposed food waste quantities in Westchester County from the commercial and residential sectors.	For 2019, in the County, it is estimated that the commercial sector disposes 103,000 tons and the residential sector disposes 85,500 tons of food waste annually. Recovery rates are anticipated in the range of 10% to 40% over time (19,000 to 75,000 tons per year) – *Refer to Section 2*
Identify available food waste prevention resources, diversion programs, and food donation in Westchester County and their potential impact to disposed food waste quantities	There are several effective industry strategies and educational tools that are available to the public and can be used to reduce food waste at the source. Food donation in the County for 2019 was estimated at less than 1,800 ton/year ; with a food rescue potential estimated between 5,500 and 10,000 ton/year – *Refer to Section 3*
Evaluate various food waste processing technologies available for implementation in Westchester County	Food waste can be effectively processed by various methods: open windrow, in-vessel composting, anaerobic digestion (AD), combination of AD and composting, and co-digestion at a wastewater treatment facility. Each method offers its own advantages and disadvantages, with varying space/utility needs, end products, upfront capital investment and operational costs. The selection of the most beneficial technology ultimately depends on a combination of factors, such as site location, site constraints, utility needs, processing capacity, etc. and not in the technology alone. Available land was found to be the most limiting factor in the County – *Refer to Section 4*
Evaluate current commercial and residential food waste management practices in Westchester County	Residential food waste (i.e. food scraps) at voluntary drop-off locations is consolidated with the food scraps collected curbside before it is hauled to the Ulster County Resource Recovery Agency

GOAL	FINDINGS
	(UCRRA) facility in Ulster County, New York, where it is composted. This facility is located about 80 miles from the center of Westchester County. Commercial food waste from the supermarket and food manufacturing sectors is mostly diverted. The remaining food waste and total commercial food waste from other commercial sectors is currently handled by private haulers and ultimately incinerated – *Refer to Section 5*
Provide a recommendation for location and technology for food waste processing in Westchester County	A phased implementation plan with mid-term (approx. 3 years) and long-term (approx. 4 years) solutions are recommended to allow for an expected ramp up process. Two mid-term County-wide solution options are presented for the processing of up to 10,000 ton/year each: Co-location of AD plant at the Peekskill Wheelabrator WTE Facility and/or Co-digestion at the County-owned Peekskill WRRF. A long-term County-wide solution consisting of the development of an AD facility at the County-owned site located in Mt. Pleasant is also presented in this Study. This facility would be initially sized for a processing capacity of 60,000 ton/year, with the ability for expansion based on processing demand – *Refer to Section 6*
Analyze and compare greenhouse gas emissions among food waste recycling scenarios	All but one of the scenarios that were modeled yielded reductions in greenhouse gas (GHG) emissions relative to the current/baseline conditions. The highest GHG reduction in the model was achieved under Scenario 5 (Co-Digestion at Peekskill WRRF with digestate WTE) – *Refer to Section 7*
Provide recommendations for interim measures	An interim solution (12 to 18 months) was identified consisting of a transfer vehicle positioned at one of the County's transfer stations for weekly loading and transportation of food scraps to an out of-County facility for composting. In this interim solution, the County would manage the transfer trailer, while food scraps would be collected and delivered to the transfer station by the various municipalities – *Refer to Section 8*
Develop a program implementation schedule for the development of a food waste processing facility(ies) in Westchester County	The overall implementation plan for the interim solution is estimated to take 12 to 18 months. Mid-term solution(s) are anticipated to take 36 months. The overall implementation plan for the long-term solution is anticipated to take approximately 48 months – *Refer to Section 9*
Identify permitting needs for the development of a food waste processing facility in Westchester County	Several permits at the state and local level may be required for the development of a food waste processing facility in the County. The specific permit needs will ultimately depend on facility type and site development requirements. It was also found that permitting is typically the critical path of the implementation process and can take as long as 24 months depending on location and technology – *Refer to Section 10*

GOAL	FINDINGS
Research funding opportunities available to the County to help off-set the implementation costs	Many Federal and New York State funding programs seem to be available to support the implementation of a food waste recycling facility in the County. Ultimately, the final scope of the project will dictate the extent of coverage and eligibility – *Refer to Section 11*
Obtain input from the community on food waste recycling interests, ideas, and concerns	Community input was obtained through two stakeholder sessions and a public forum held during the development of the Study – *Refer to Section 12*

1. PROJECT BACKGROUND AND INTRODUCTION

The process of evaluating food waste management options in Westchester County began with Woodard & Curran's March 2018 Preliminary Food Waste Analysis, which preliminarily assessed key factors that impact the overall feasibility of a formal food waste diversion program and recycling facilities within the County, with an initial primary focus on the large commercial food waste generators that produce more than two tons of food waste per week, and secondarily, the residential food waste stream.

The intent of the March 2018 Study was to utilize the information generated and evaluate the merits of moving forward with additional planning and a more detailed analysis to support food waste recycling and project implementation within the County.

Following the March 2018 Study and in response to public interest and the Food Donation and Food Scraps Recycling Act that requires large commercial food waste generators (i.e. generating more than 2 tons/week) to separate edible and inedible food and divert inedible food waste to a recycling facility, provided there is a facility within a 25-mile radius, Refuse Disposal District No.1 (the "District") through the Westchester County Department of Environmental Facilities (WCDEF) and the Department of Public Works and Transportation (WCDPWT) retained Woodard & Curran to study and evaluate the feasibility of incorporating various food waste management options into the County's Solid Waste Management Plan.

This Report provides important considerations and planning guidance for the implementation of a food waste processing facility in Westchester County.

2. FOOD WASTE QUANTITY ESTIMATES

2.1 Commercial Food Waste Quantity Estimates

Background & Methods

Woodard & Curran, with the support of Center for Eco Technology (CET), surveyed businesses and institutions across ten unique commercial sectors in order to estimate total annual commercial food waste generation in Westchester County (refer to Table 1). Subsequently, CET's Food Waste Estimator[2] was applied to derive food waste generation estimates for individual entities. The purpose of this exercise was to refine the initial food waste estimate calculated as part of the March 2018 Study Report.

The Food Waste Estimator is a tool developed by the Center for Eco Technology (CET) on behalf of the Massachusetts Department of Environmental Protection's Recycling Works program, which CET administers. The tool was designed for estimating relative levels of food waste generated by entities that do not have food waste diversion programs in place. The tool comprises metrics for ten key food waste generating sectors and for each sector, metrics were compiled from industry data in published reports and studies and were last updated in May 2018. For each sector, the tool includes three to four different metrics for estimating food waste, such that one can derive an estimate by averaging or triangulating numbers derived from multiple metrics.

In the case of Westchester, 61 entities were interviewed across ten sectors. Entities were chosen such that the total sample for a given sector was representative of the range in size and scale of activity for the sector. For an entity to be included in the analysis, data for a minimum of two metrics was collected; if data for fewer than two metrics were available the entity was discarded. Based on the degree of agreement or discrepancy among estimates derived from each metric, the final food waste estimate for an entity was averaged or triangulated from these numbers at the discretion of the CET researcher in an effort to derive a representative sample.

Based on the data collected from each of the surveyed entities, and the results of scaling those numbers across each sector, estimated food waste generation in Westchester County is 125,000 ton/year. Of the total, 103,000 tons is estimated to be disposed yearly. The difference between total food waste generated and disposed is due to the supermarket and food manufacturing sectors where donation and other forms of diversion are already routine for many entities. Based on interviews with food manufacturers and supermarkets, the former were already diverting the vast majority of their food waste. This is consistent with findings of food manufacturing in other states, where it is simply more cost-effective to divert rather than haul as trash consistent quantities of a known food waste stream. Supermarkets interviewed in Westchester described significant donation programs, thus 33% diversion of wasted food to donation was assumed. This may be an overestimate based on follow-up conversations with food rescue organizations in Westchester, which described untapped potential among supermarkets (Refer to Section 3 – Food Waste Diversion Programs).

Food waste estimates for Westchester County were also compared to other locations and food waste studied. Based on total commercial waste generated in Westchester County in 2018 (refer to Table 2 and Figure 2), the disposed food waste estimate represents 21% of commercial MSW. In comparison to reference data points, the estimate for Westchester is quite reasonable. CalRecycle conducted a commercial sector waste characterization in California and

[2] More information about the tool is available at: https://recyclingworksma.com/food-waste-estimation-guide.

found that food comprised 24% of disposed waste[3]. In Rhode Island, food waste comprised about 18% of commercial disposed waste prior to the organics ban[4].

2.1.1 Comparative Analysis and Validation

A separate comparative analysis was also completed using a recent study[5] published by the Natural Resources Defense Council (NRDC) on food waste in three U.S. cities: New York City, Nashville, and Denver (refer to Table 3).

Using information from NRDC's study, food waste generation per capita was calculated and applied to Westchester County to estimate food waste generation from the commercial sector (refer to Table 4). Using this approach, the low-end commercial food waste estimate for Westchester falls only slightly higher than the estimate calculated using surveys and the Food Waste Estimator.

It should be noted that NRDC adopted conversion factors from the EPA's Study, "Technical Methodology for the U.S. EPA Wasted Food Opportunities Map" and used the Food Loss and Waste Standard (FLW) for estimating commercial and institutional waste. Entities included in the study, and the key facility-level information used to estimate food waste is shown below.

Sector	Metric
Colleges & Universities	Number of students
Correctional Facilities	Number of inmates/beds
Events & Recreation Facilities	Number of seats
Food Manufacturing & Processing	Revenue
Food Wholesalers & Distributors	Revenue
Grocers & Markets	Number of employees
Health Care	Number of beds for hospitals; revenue for nursing homes
Hospitality (Hotels)	Number of employees
K-12 Schools	Number of students, grade levels
Restaurants & Caterers	Number of employees

Results from the NRDC's study included in Table 3, show that the restaurant sector is by far the biggest commercial generator, contributing up to 50% of total food waste. Likewise, in Westchester, full-service restaurants represent 41% of the total food waste estimate and limited-service restaurants another 25% (refer to Table 5). The higher percentage in Westchester makes logical sense given that the County is likely to have a lower density, but potentially higher number of restaurants spread over the entire area. Other sectors with good alignment between the NRDC Study and

[3] Cascadia Consulting Group (2015). "2014 Generator-Based Characterization of Commercial Sector Disposal and Diversion in California," CalRecycle, California Department of Resources Recycling and Recovery.

[4] DSM Environmental Inc. (2015). "Rhode Island Solid Waste Characterization Study," Rhode Island Resource Recovery Corporation.

[5] NRDC (2017). "Estimating Quantities and Types of Food Waste at the City Level", Natural Resources Defense Council, New York.

Westchester estimates include food manufacturing, supermarkets, and hospitals (healthcare). Figure 1 shows the commercial food waste generation across the commercial sectors in Westchester County.

A second comparative analysis was completed using information from the New York Pollution Prevention Institute (P2i). P2i at the Rochester Institute of Technology leads the NYS Food System Sustainability Clearinghouse, a project that includes its own organics locator and estimator for New York State.[6] The Organics Locator includes many of the sectors considered in our estimates and rely on a simplified version of CET's Food Waste Estimator; however, it is not a comprehensive database of all food waste generators for all sectors across the County. In comparing estimates from the P2i tool with our estimates, the former tends to have higher estimates on an individual entity basis[7] whereas total estimates for a sector depend on how comprehensive the data is for that sector (refer to Table 6). For example, the Organics Locator only includes a total of 274 restaurants in Westchester County, whereas CET identified 2,202[8]; and therefore, P2i's total food waste among restaurants is significantly lower.

Because the Organics Locator is not a complete dataset, as a bench-marking exercise one should compare individual sectors that are complete – not the outcomes for total food waste across the County. As shown in Table 6, the estimate for colleges and universities, correctional facilities, hotels, and supermarkets are all higher than our estimates. It is important to note that the Organics Locator does not account for any differences between generated and disposed waste. Both total food waste generation and the volumes already being diverted for donation or alternative processing were captured in the analysis (refer to Table 5).

In summary, our food waste estimates for Westchester County seem quite reasonable and likely conservative, as validated through comparative results using both NRDC's urban food waste studies and P2i's Organics Locator dataset.

The associated spreadsheet, "Westchester Commercial Food Waste Data" (included in Appendix A), presents all of the raw data and assumptions used for extrapolation of food waste by sector across the County. Sensitivity analyses around the number of entities in a given sector, the average food waste generated by an entity in a sector, and portion being diverted may be computed for generating an indicative range for commercial food waste generation in Westchester County.

2.2 Residential Food Waste Quantity Estimates

Residential food waste generation in Westchester County was estimated using a "pounds food waste per person per week" conversion factor, which was an average of that used by U.S. EPA and those found in the NRDC's Study in New York, Nashville, and Denver, respectively. Based on a population of 967,612 for Westchester County[9], the conversion factors ranged from 2.8 lb food waste/person/week (U.S. EPA) to 4.2 lb food waste/person/week (Denver), yielding a total residential food waste estimate for Westchester between approximately 70,000 and 106,000 ton/year. Averaging the four conversion factors, the residential food waste estimate for Westchester County is assumed to be 85,537 ton/year (refer to Table 7).

For additional validation, residential food waste estimates were calculated as a fraction of the residential MSW and total MSW for the County, each coming in at 22%. A 2017 Study of residential curbside waste in New York City found

[6] Organic Resource Locator available at: https://www.rit.edu/affiliate/nysp2i/food/organic-resource-locator.

[7] See associated spreadsheet "P2i Food Waste Data" for direct comparison between CET and P2i estimates for select entities.

8 Based on Westchester County GIS data available in July 2019

[9] Source: United States Census Bureau (July 2018). Available at: https://www.census.gov/quickfacts/fact/table/westchestercountynewyork/PST045218.

that about 21% was food waste[10] and the national average fraction of food waste in combined commercial and residential MSW is 22%[11]. Therefore, our residential food waste estimated for Westchester County seem reasonable when compared to other sources of information. Table 8 shows the residential food waste estimates as a percentage of the total waste in Westchester County, and Figure 3 shows municipal food waste figures for year 2018 in Westchester County.

[10] NYCsanitation and NYCzerowaste (2017). “NYC Residential, School, and NYCHA Waste Characterization Study,” New York City Department of Sanitation.

[11] U.S. EPA, Sustainable Food Management. “United States 2030 Food Loss and Waste Reduction Goal”. Available at: https://www.epa.gov/sustainable-management-food/united-states-2030-food-loss-and-waste-reduction-goal

3. FOOD WASTE AVOIDANCE AND DIVERSION

3.1 Resources for Commercial Food Waste Disposal Avoidance

There are several methods and tools for helping commercial food service institutions reduce and avoid food waste. Measures include both pre-consumer “back of house” and post-consumer “front of house” strategies to prevent wasted food. Many of these strategies are simple, cost-effective, and provide enormous environmental and social benefits.

Widespread implementation of food waste prevention strategies has potential for enormous impact on commercial food waste generation on a city or county scale. Individual case studies of commercial kitchens that employ the Leanpath food waste tracking system, for example, routinely achieve dramatic food waste reduction rates. Since implementing Leanpath, an IKEA store in Switzerland reduced food waste weight by 45%; the University of Illinois achieved a 63% reduction in food waste; and Novotel in Brisbane cut food waste by 66%.[12] New York State’s recently passed Food Donation and Food Recycling Act will bring food waste into the spotlight for food waste generators. In light of the Act and public awareness campaigns around food waste prevention that will emerge from it, it may be reasonable to assume a 10% reduction in commercial food waste in Westchester County as a result of prevention activities.

This section provides a summary of prevention strategies and resources available for food waste prevention and education.

Prevention Strategies

- Some of the prevention strategies that can be used to reduce wasted food before it reaches consumers’ plates, include:
- Food purchasing and procurement strategies:
- Track purchasing history against consumption to align food supply and demand.
- Identify foods that are commonly wasted and scale back or eliminate from the menu.
- Procure food of high quality with a longer shelf life.
- Source imperfect produce and help combat the 20 billion pounds of food that go to waste on farms every year.

➢ Food waste tracking technologies:

- Rigorous tracking is a powerful method for revealing food waste trends and opportunities for improving back and front of house practices that lead to waste reduction.
- Galley is a digital platform for food production that helps manage inventory, plan shopping lists, and scale and cost intended menus.
- Leanpath is a food waste tracking platform that integrates a scale, camera, and touchscreen user interface.
- Phood is a digital platform that tracks food waste and helps facilitate food donation.
- Winnow is another digital platform for tracking food waste and costs.

[12] Leanpath. “See why so many food service and hospitality leaders use Leanpath”. Available at: https://www.leanpath.com/industries/

- Storage and inventory strategies:
  - Ensure food is properly handled and stored to prevent damage and spoiling.
  - Incorporate first-in first-out storage and rotation systems for your perishable foods.
  - Tag items for priority use with "use first" label
  - Label prepared food with descriptive language rather than simply a date (e.g., use by, freeze by, etc.).
  - Avoid inventory shrinkage by taking frequent physical inventory and comparing it to what should be on hand based on sales and usage.
  - Perform preventative maintenance on refrigerators and freezers to avoid catastrophic down time and potential food loss from inadequate temperature control.
- Preparation methods:
  - Employ root-to-stalk cooking (using the entire vegetable) along with nose-to-tail cooking (using the entire animal) to reduce food scraps and make healthy and delicious stocks.
  - Ensure that kitchen staff have proficient knife skills, minimizing food waste during trimming and cutting.
  - Cut food uniformly for evenly cooked and aesthetically pleasing dishes.
  - Repurpose surplus food or food items that are not appealing to customers (overripe bananas, bruised fruit, stale bread).
  - Avoid using garnishes that do not get eaten.
- Cooking and serving:
  - Practice batch or just-in-time cooking. Preparing food in small batches improves food quality and limits overproduction. On-demand cooking consists of pre-ordered and portioned dishes.
  - Offer different portion options or pre-plated and portioned meals and desserts to regulate the amount of food customers take. Smaller plate sizes have also been shown to significantly reduce food waste.
- Special events:
  - Discuss food waste prevention efforts with vendors prior to events and communicate last minute changes with culinary staff.
  - Source food from vendors that limit waste.
  - Ensure contracts include food waste reduction and food recovery strategies, along with solid waste reduction and recycling.
  - Require updated headcounts prior to, and day of, the event.
  - Hold post-event meetings to discuss successes and areas for improvement.
- Dining hall layout and presentation:
  - In buffet and self-serve settings, encourage customers to take only what they will eat:
    - Incorporate trayless dining and/or smaller plates to limit the amount of food customers take;
    - Design the dining hall to minimize lines and discourage over-loading.

- Avoid refreshing chafing dishes. Instead, transfer food into smaller dishes, and use upside down trays or other items to fill empty space and make the buffet look full and inviting.
- Minimize the depth of buffet trays such that they can be made to look full with less food.
- Orient pastry and cookie trays horizontally in display cases to make the case appear full.
- Consider taste stations to introduce consumers to small bites of lesser known items.

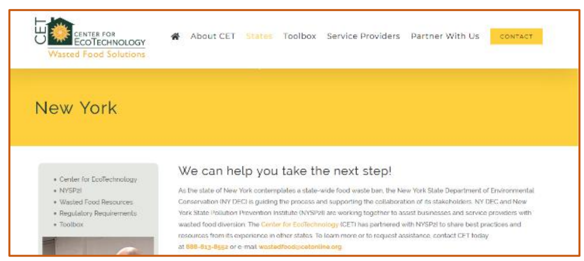
➢ Education and signage:

- Strategically place educational signage and/or digital screens around dining areas to increase awareness about wasted food:
    - Consider a variety of messaging, from data about the amount of food wasted, to associated financial, environmental, and social costs;
    - Help connect people to their food by providing information about its source and the fate of food that is not consumed.

Commercial Sector Resources

There is a vast number of resources available to assist commercial entities with food waste prevention and education. The following educational resources, campaigns, and toolkits are some examples:

Wasted Food Solutions.



A web-based tool-kit developed by the Center for EcoTechnology. The platform houses best practices for commercial food waste reduction and diversion and several state-specific policies and guidelines. The dedicated New York State page includes several local food waste reduction tools and fact sheets developed by CET and the Harvard Food Law and Policy Clinic on liability protections and tax incentives for food donation.

New York State Pollution Prevention Institute: Sustainable Food Program.

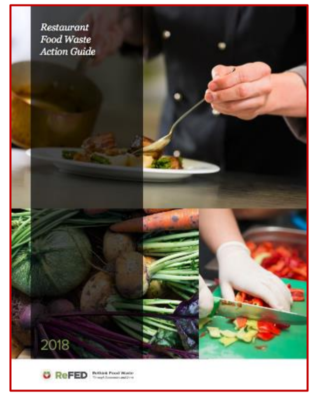
NYS P2i maintains a clearinghouse of resources for food waste reduction including access to direct technical assistance for commercial generators, applied research, and an online food waste toolbox that includes the NYS Organics Locator, a food waste estimator tool, and step-by-step guide for food waste reduction.

Hotel Kitchen Food Waste Toolkit.

Developed by the World Wildlife Federation and American Hotel and Lodging Association, this resource is directed at the hospitality industry and aims to raise awareness about food waste and provide tips for reducing it. WWF documents a 12-38% reduction among hotels that put the strategies to work.

Food Waste Culinary Instructor Curriculum.

A food waste prevention training program for culinary instructors developed by the James Beard Foundation.



Food Recovery Challenge.

Hosted by the US EPA, businesses, non-profits, and schools can make a pledge to reduce food waste. Aside from the financial, social, and environmental benefits that derive from taking the Food Recovery Challenge, participants enjoy public recognition, free technical assistance, and awards.

Food Waste Action Guides.

Developed by ReFED and tailored for various sectors of food waste generators including restaurants, food service providers, and retailers.

Food Waste Reduction Alliance.

A collaboration between the Grocery Manufacturers Association, the Food Marketing Institute, and the National Restaurant Association that aims to tackle the root causes of food waste and to facilitate donation and recycling of unavoidable food waste.

Tools for Preventing and Diverting Food Waste.

A wide range of tools and guidelines developed by the US EPA to help commercial entities and schools track and reduce food waste and quantify its environmental impacts.

Using Data to Reduce Food Waste.

An eBook by Spoiler Alert that provides guidelines for using data to reduce food waste.

Educational Sector Resources

There is also a number of resources available and catered to assist the educational sector with food waste prevention and reduction. The following educational resources, campaigns, and toolkits are some examples:

Food Scraps Diversion Guide: West Hartford Public Schools.

Best management practices for setting up successful food waste prevention and diversion programs in schools, including share tables, donation, and recycling. The guide was developed by the Center for EcoTechnology in collaboration with the West Hartford School District and much of the information can be widely transferred to other cities and states.

The Campus Kitchens Project.

A national campaign to catalyze food donation programs on high school and university campuses, redirecting food waste to local food rescue organizations. There aren't any participating schools in Westchester yet but there are across New York State.

Food Waste Warrior Toolkit.

A campaign by the World Wildlife Federation that includes lesson plans, activities, and resources for informing children about the impact of food choices and food waste on the environment.

K-12 Food Recovery Roadmap.

A rich set of resources for schools compiled by BioCycle.

K-12 Food Rescue

A non-profit that provides training tools to local leaders so they can implement successful food rescue programs in their schools and other institutions.

Other educational resources, campaigns, and toolkits that are available to assist the residential sector with food waste prevention and reduction include:

Save the Food.

A public awareness campaign launched in 2016 by the Natural Resources Defense Council and the Ad Council. The campaign includes tips for food storage, recipes for root-to-stock and head-to-tail cooking, menu planning, and has been modified for various media types including web, TV, print, radio, and outdoor advertising.

NY State DEF Guide to Backyard Composting.

The Westchester County Department of Environmental Facilities endorses backyard composting as a direct action that households can take to divert food from the waste stream. With partial funding from the NYS DEC, the Westchester DEF produced a how-to guide for composting yard waste and kitchen scraps.

NY State Food Recovery Campaign.

A state-wide campaign led by the New York Association of Reduction, Reuse, and Recycling that aims to prevent food waste, divert surplus to the hungry, and recycling food scraps. The website includes a rich set of resources for residential and commercial entities.

Zero Waste Toolkit, Sustainable Westchester.

Sustainable Westchester is working on a website and phone app to assist residents with locating waste management facilities and determining collection schedules for their neighborhoods.

Composting for Community, Institute of Local Self Reliance.

A rich database of written and video resources for backyard and community composting.

Feeding the 5000.

Communal meals prepared strictly with food that would have otherwise been disposed. The events are held in cities and serve 5000 people to showcase the magnitude of the food waste problem – particularly the disposal of edible food. Feeding the 5000 is organized by a London-based non-profit, Feedback, which also runs a number of other food waste campaigns including a date labeling campaign and a supermarket scorecard among others.

Love Food, Hate Waste.

A campaign by the UK-based organization, WRAP (Waste and Resources Action Programme) that focuses on the environmental and economic costs of food waste. The campaign uses various media platforms to share facts, tips, and recipes to help reduce food waste.

Think.Eat.Save.

A campaign by the United Nations Environment Program (UNEP) and the Food and Agricultural Organization (FAO) to raise awareness about the global food waste crisis. The website includes videos, articles, and various tips on reducing food waste.

Additional Resources

In addition to the commercial and educational sector tools listed above, the following tools and resources available for assistance in food waste prevention and reduction across any sector.

Tools

EPA Tools for Preventing and Diverting Wasted Food
FDA Refrigerator and Freezer Storage Chart
Hotel Kitchen Food Waste Toolkit (WWF)

Guidance documents and videos

ConServe Program (National Restaurant Association)
Food Waste Action Guides (ReFED - available for restaurants, retailers, and food service providers)
Food Waste Culinary Instructor Curriculum (James Beard Foundation)
Food Waste Reduction Alliance
Reducing Food Waste by Changing the Way Consumers Interact with Food (New Venture Fund)
Storage tips and campaign assets (Save the Food)
Using Data to Reduce Food Waste (Spoiler Alert)

3.2 Food Waste Recovery Potential in Westchester County

This section presents an estimate of the amount of edible food that could be recovered for donation in Westchester County. It is widely documented that much of the food that gets disposed is in fact edible.[13][14][15] Therefore, it stands to reason that there is opportunity for recovering some portion of the approximately 110,000 tons of commercial food waste that are disposed each year in Westchester County.

Two methods to estimate food rescue potential were included in the analysis. Given that New York's *Food Donation and Food Scrap Recycling Act* becomes effective in January 2022, the first method considers the impact that organics waste bans in other states have had on levels of food waste diverted from disposal to donation. The same marginal impact is applied to Westchester to derive a volume of potential food donation. The second method uses values found in the literature for the percentage of commercial food waste that could potentially be recovered for human consumption. The first method could be considered the more conservative practical estimate, while the second method is an indicator of the volume of edible food in the wasted food stream.

As a reference, in Massachusetts food rescue increased 60% from 4,211 tons in 2014 to 6,727 tons in 2017 as a result of the state's commercial food waste ban. As a percentage of total food waste being diverted, food rescue still only

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[13] Berkenkamp, J. and Phillips, C. (2017). "Modeling the potential to increase food rescue: Denver, New York City, and Nashville," Natural Resources Defense Council, NYC.
[14] Parfitt, J., Woodham, S., Swan, E., Castella, T., Parry, A. (2016). "Quantification of food surplus, waste, and related materials in the grocery supply chain," WRAP, UK.
[15] Do Something! "Reduce food waste: fast facts on food waste" Available at: http://www.foodwise.com.au/foodwaste/food-waste-fast-facts/.

represents less than 4% of the approximately 180,000 tons diverted (2017), and a minute fraction – 0.7% – of all food waste being generated statewide (~1 M tons[16]). In Vermont, food donation increased 40% between 2015 and 2016, coinciding with the organics recycling law taking effect for large supermarkets.[17]

While the organics waste bans in MA and VT both defer to the US EPA's food waste hierarchy and prioritize prevention and donation over other diversion strategies, New York's Act goes a step further and requires designated food scrap generators to separate edible food for donation and submit an annual report to the State on how much they donate.[18]

If Westchester achieves the same 40-60% increase in food rescue that was demonstrated in Vermont and Massachusetts after implementation of their organics waste bans, the marginal tonnage from the commercial sector would be equivalent to between 712 and 1069 tons of food per year.

In their "Benefit-Cost Analysis of Potential Food Waste Legislation," The New York State Energy and Research Development Authority (NYSERDA) modeled scenarios where 5% and 10% of all commercial food waste were diverted for donation. Under these scenarios and using CET's estimate of food waste generation in Westchester, the total food rescue potential would be 5,500 to 10,000 ton/year. NYSERDA acknowledged that such food rescue projections are aggressive given the real food rescue rates in VT after the waste ban.

The NRDC, in connection with their Study on food waste generated in Denver, New York City, and Nashville, also calculated the hypothetical food rescue potential in these cities.[19] Through a series of interviews with food waste generators combined with commercial waste audits, researchers determined the average portion of food waste that could be rescued from the food waste stream per sector. Restaurants were found to have very little potential since 65-90% of the food waste is post-consumer, whereas in the grocery sector, 33% of the food waste per entity could theoretically be rescued. In the middle were hospitality, healthcare, and colleges and universities, for which 5-10% of the food waste stream could be rescued. The NRDC's finding of significant potential for grocery stores was echoed by food rescue organizations in Westchester, who said in interviews that while many grocery stores already have donation programs in place, there is significant opportunity for most outlets to increase rescue of perishable food, like produce, meat, and dairy. Donation of these types of foods from grocery stores has seen an increase in nearby states.

To estimate the volume of food waste that could potentially be rescued across a city, NRDC researchers also assigned participation rates to each sector – that is, the percent of entities in a given sector that would participate in food donation (refer to Table 9). Based on the assumptions of food rescue per sector and participation rates, NRDC calculated food rescue potential for Denver, NYC, and Nashville (refer to Table 10).

For the commercial sector, if the NRDC's estimated ranges for food recovery are applied to Westchester County, annual food rescue from the current waste stream is between 913 tons (at 0.83% of the waste stream) and 5,720 (at 5.2% of the food waste stream). The lower limit is well aligned with the waste ban associated estimate, whereas the upper limit is indicative of a best-case scenario if sufficient resources and education are directed at maximizing food rescue.

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16 MassDEP (2013). "Massachusetts Solid Waste 2010-2020 Master Plan: Pathway to Zero Waste," Executive Office of Environmental Affairs, Massachusetts Department of Environmental Protection.

17 Vermont Foodbank (September 2016). "Universal recycling law boosts fresh food donations," Available at: https://www.vtfoodbank.org/2016/09/universal-recycling-law-boosts-fresh-food-donations.html.

18 Brown, M. (April 12, 2019). "New York State Passes Landmark Food Waste Bill," NRDC. Available at: https://www.nrdc.org/experts/margaret-brown/new-york-state-passes-landmark-food-waste-bill.

19 Berkenkamp, J. and Phillips, C. (2017). "Modeling the potential to increase food rescue: Denver, New York City, and Nashville," Natural Resources Defense Council, NYC.

In Westchester County there are two food rescue organizations that handle the majority of food recovered from commercial entities: Feeding Westchester and County Harvest. For FY2019, the two organizations rescued a combined ~1781 tons of food from the commercial sector. During interviews with CET, Feeding Westchester described a target of at least 1500 tons in FY2020 and County Harvest is aiming for growth of 50 tons per year; historical growth trends are presented in Table 11.

While the untapped food rescue potential in Westchester may only be a small fraction of the wasted food stream, it represents very significant potential impact for the two primary organizations, Feeding Westchester and County Harvest. For example, rescuing an additional 900 tons of food per year would represent a 50% increase in current recovery rates and could provide the equivalent of approximately 1.2 M additional meals for the county’s food insecure.

Based on the food rescue landscapes in other locations, such growth will take significant public education and awareness raising, as well as capital investments, particularly in vehicles and cold storage. Transportation between donors and recipients is a key bottleneck in many food rescue markets, which has triggered the emergence of organizations such as Rescuing Leftover Cuisine, MEANS, Lovin’ Spoonfuls, and Food Rescue US that are all dedicated to pick up and delivery of food donations. These organizations are not currently active in Westchester County but may be necessary to unlock the market.

It is also important to note, that potential donors worry about liability, making fear of donating a major constraint to food rescue. Therefore, it is important to raise awareness about the federal Bill Emerson Good Samaritan Food Donation Act, which protects donors from liability when donating to nonprofit organizations and protects donors from civil and criminal liability should the product, donated in good faith, later cause harm to the needy recipient. CET, NYSDEC and the Harvard Food Law and Policy Clinic recently developed several fact sheets on food donation laws in New York State that can be used to educate target donors and allay concerns: Liability Protections, Date Labels, and Tax Incentives.

Figure 4 provides a summary of the commercial food waste generation in Westchester County broken down by estimated food waste disposed, baseline diversion levels (driven by food manufacturers), and estimated increase in food donation with New York’s Food Donation and Food Scrap Recycling Act (effective 2022).

4. FOOD WASTE PROCESSING TECHNOLOGIES

4.1 Food Waste Technology Analysis

This Study focused on five common methods and technologies for food waste processing —open windrow composting, in-vessel composting, anaerobic digestion, combination anaerobic digestion with composting, and wastewater treatment plant co-digestion. This section provides a general overview of each technology, along with their estimated land requirements and costs per ton of food waste processed. A Food Waste Processing Technologies Matrix is included as Figure 5 and summarizes key information for each technology.

4.1.1 Open Windrow Composting

Open windrow composting systems involve piling organic materials in long outdoor rows, called windrows. Windrows are usually between six and 10 feet high and between 12 to 20 feet wide. Their length is constrained by the available land area. Windrows are typically placed on paved surfaces or low-permeability soil surfaces to minimize infiltration of leachate from the windrows to the ground. Aisles of empty space are required between windrows to allow for equipment maneuverability and to access the windrows.

The height, width and shape of the windrows will vary depending on the content of the organic material being processed and the approach chosen to manage and turn the windrows. Windrows can be covered or uncovered depending on the technology or method selected. During the initial active decomposition phase, where freshly placed food waste begins decomposing, the windrows can be either turned by an excavator or actively aerated with an air pump and piping to maintain oxygen content and porosity throughout the piles.

Prior to being placed in windrows, food waste needs to be pre-treated with equipment that separates contaminants, such as bags and other inorganic materials from food waste to create a consistent stream of materials. A windrow composting facility typically has four components; a tipping area where material is received, a staging area, a blending area where traditional green waste is blended with the food waste, and the windrow composting area where material is actively composted.

For outdoor windrow composting, excessive rainfall can affect the efficiency of the active decomposition phase in turned windrows by increasing the moisture content in the windrows beyond desirable levels. Runoff controls typically are required to channel surface water discharge to a wastewater collection system.

Depending on the control parameters, such as turning frequency and waste stream contents, active composting time for uncovered windrows will usually range from eight to sixteen weeks. Windrows can be placed in buildings or under cover to address odor, rainfall and surface runoff issues, but the use of buildings or other structures as cover may be limited by the size and number of windrows required for a facility.

Windrow composting systems are the least costly composting technology, when considering capital investment in buildings and equipment, but require large land areas to accommodate the windrows and operating zones. The amount of food scraps that can be added depends on multiple factors including the correct ratio of carbon and nitrogen, the average food particle size to maintain sufficient porosity in the windrow to allow proper air flow, and proper bulk to maintain stability of the pile.

The efficiency of the composting process and the quality of the final compost product are limited by the types of organic inputs. Harder food wastes can take much longer to compost or may not break down in the same time frame as other food wastes. Food waste such as nut shells, dry pasta or beans, corn cobs, and hard fruit pits will take longer to compost and may need to be screened out. Animal product food waste, such as meat, bones, fish, butter, lard, and dairy products are known to cause overheating issues in compost piles. When these wastes are present, organisms that decompose animal products can release excess heat, creating poor environmental conditions for the types of organisms that decompose plant-based materials. This can be managed by avoiding large homogenous inputs of animal products and instead apportioning animal products with plant products. Animal products mixed in with regular household food waste are unlikely to pose a problem, but large inputs from commercial food waste generators may need unique management. In addition, compost piles can handle only small amounts of food scraps mixed with soiled paper, yard trimmings or other non-food organic materials without significant impacts on the decomposition process. There are also many products that should not be accepted by a composting facility but may end up being accepted through error. Materials such as herbicide-covered yard waste, pet droppings, inorganic materials, and diseased plant materials should be excluded and may harm the composting process or be present and uncomposted in the final compost product.

For reference, composting 10,000 ton/year with open windrows would require approximately 3 to 4 acres of open land, with additional space requirements for screening or odor and noise buffering when located in close proximity to residential areas. That area can be reduced to 2 to 3 acres if a suitable aeration system is added to the system. Excluding land costs, the total capital cost to develop a windrow composting facility is approximately $50-$70/ton or $500,000 to $700,000 for a 10,000 ton/year facility. The annual operating expense is estimated to be between $15 and $20 per ton of compost stored at the facility. Water utility connections would be required for compost saturation, wash down, and fire control. Sewer utility connections could be utilized to collect and manage leachate. Electrical utility connections would be required for typical electric needs for a building. Open windrow composting facility would require about 4 staff members per 10,000 ton/year of food waste. The staff would be a combination of equipment operators and trained composting managers.

Open windrow composting facilities typically have the advantage of requiring lower operating expenses and lower initial capital requirements than other options due to limited needs of storage, buildings and equipment. However, capital costs can increase significantly depending on site conditions and proposed site features, such as a covered processing yards, site screening, landscaping, etc. Another advantage is that open windrow composting facilities are relatively straightforward to operate.

One main disadvantage for open windrows composting, however, is that land needs are high since traditional composting does not break down food waste as rapidly as other technologies and open space is required for equipment maneuverability. The limited ability to take contaminated food waste materials or certain types of food waste, such as commercial packaged goods, proteins, and bulk liquids is also a weakness of this technology. Other disadvantages with open windrows composting include the need for leachate and stormwater runoff control requirements to manage liquids created from compost processes. Also, odors and air emissions are harmful to the environment as the compositing process releases methane, an undesirable greenhouse gas. Finally, open windrows composting is more susceptible to fires than other methods.

4.1.2 In-Vessel Composting

In-vessel composting involves placing organic materials in a vessel reactor in batches, or in a continuously fed stream, using front-end loaders, loading conveyors and/or loading hoppers. Vertical vessel silos can be used to allow larger quantities of organic materials to be processed in smaller land areas. Organic materials are typically fed into the top of the vessel and removed from the bottom. Horizontal vessels, such as rotating drums, containers, or enclosed tunnels or channels, require a larger land area than silo systems, but either vessel style will require less land area to process similar volumes of material than windrow systems, since the material’s retention time is lower.

The size of the vessels will vary depending on the type and the volume of organic materials to be processed. In-vessel composting is typically performed within a well-ventilated building, equipped with odor capture devices and equipment to scrub the ammonia-rich air created by the composting process. During the active composting phase, the organic materials are aerated either by forcing air through the vessel or by mechanically agitating the material. Agitation systems, such rotary drums, agitated beds, or augers break up the organic materials, providing microorganisms with better access to the nutrients needed for digestion. Water is added as needed to maintain the moisture content in the organic materials. The composting phase requires frequent monitoring of the control parameters and adjustments to the oxygen and moisture content to maintain optimum conditions for composting.

Common in-vessel aerobic composting systems include:

- Horizontal rotary drums that continuously mix, aerate and move the organic materials. Drums can range from 4 to 12 feet in diameter and 50 to 175 feet in length.
- Enclosed containers that use fans to force aerate the organic materials without internal agitation. Container capacity can range from 20 to 110 cubic yards.
- Long channels with concrete walls that contain agitated beds with air forced through the underside of the beds. These systems are typically operated as continuous systems with organic materials fed into the channels at one end, and the agitation process moving the material to the other end for removal as finished compost. Channel lengths typically range from 200 to 300 feet.

In-vessel composting has similar limitations on inputs as open windrow composting. Food waste such as nut shells, dry pasta or beans, corn cobs, hard fruit pits, meat, bones, fish, butter, lard, dairy products, soiled paper, and yard trimmings have the same issues as described in Section 4.1.1. There are also many products that should not be accepted by a composting facility, but may end up being inadvertently accepted, as with open windrow composting. While many of these products pose a similar issue as with open windrow composting, the level of control over the environmental conditions in in-vessel composting can allow operators to more effectively mitigate the risks by separating different materials in different vessels and using different moisture and temperature controls for different materials.

In-vessel aerobic composting systems have a higher capital cost than open windrow systems but offer a greater level of control over composting parameters. These systems allow for better odor control, better aeration, a shorter processing time, and require less land area than windrow systems.

For reference, composting 10,000 ton/year of food waste in an in-vessel facility is estimated to require about 2 acres of land. Additional land may be required if finished composted material will be stored on site. The total capital cost to develop an in-vessel composting facility is approximately $80-$100/ton or $800,000 to $1,000,000 for a 10,000 ton/year facility. The annual operating cost is estimated to be between $100 and $130 per ton of food waste. Water utility connections would be required for compost saturation, wash down, and fire control. Sewer utility connections could be utilized to collect and manage leachate. Electrical utility connections would be required for agitation technologies. It is estimated that an in-vessel composting facility would require about three staff per 10,000 ton/year of food waste. These staff would primarily be monitoring and actively controlling the composting parameters.

Two main advantages of in-vessel composting is that it requires less land than open windrow composting, and the composting process is accelerated resulting in lesser processing times. In addition, enclosed composting controls odor emissions and leachate better than traditional composting and less manual handling is typically required as compared to windrow composting.

Some of the disadvantages to in-vessel composting are that it requires costly and sophisticated air handling and odor control equipment, energy needs are higher for this form of composting, capital costs are typically higher due to equipment costs, and the overall operation required more persistent monitoring.

4.1.3 Anaerobic Digestion

Anaerobic digestion is a naturally occurring biochemical process wherein microorganisms break down organic material in a low- or no-oxygen environment. The digestion process takes place in a heated, sealed vessel or container. The heat can be generated using an external energy source such as natural gas from a utility or methane captured from the anaerobic digestion process. Anaerobic digestion relies on multiple control parameters within the vessel or container that control the efficiency of the digestion process. These control parameters include the ratio of carbon to nitrogen, the moisture content, the pH level, the size of the organic material, the temperature, and the amount of volatile organic solids in the organic materials being processed. Food waste is pretreated by removing inorganic materials to create clean food waste. Depending on the method of digestion, the addition of water may be required. The digestion process occurs in the absence of oxygen and in a digestion vessel over a continuous process that requires approximately 21 days to complete. Typically, temperatures in the vessel must be kept above 128˚F.

Biogas is produced on a continuous basis as a byproduct of the digestion process. The biogas can be purified and upgraded and used to power a combined heat and power unit. The biogas can be further purified and used as pipeline or vehicle grade fueling. The amount of biogas generated per ton of waste is dependent on the type of waste.

Once the digestion process is complete, the remaining food waste represents a 70% reduction in volume. The food waste can be dewatered to further reduce the volume and the solids from the dewatering process constitute finished compost, which can be dried to create pelletized organic fertilizer. The water can either be reused in the digestion process or treated and discharged.

Anaerobic digestion has fewer limitations on the types of materials that can be used as inputs than composting processes. In addition to regular food waste, most types of organic matter can be accepted in an anaerobic digester, including leaves, grass, paper products, and pet and human waste. Because the process includes shredding and pulping, anaerobic digesters do not have trouble processing animal products or harder food wastes in the same way that composting processes do. Anaerobic digestion does have trouble processing wood wastes, as anaerobic bacteria are not suitable for efficiently processing wood. Anaerobic digestion is more sensitive to nonorganic inputs. Plastic, glass, and metal contaminants can damage processing equipment if not properly screened out. However, depackaging and screening machinery is available for anaerobic digester pretreatment and sorting.

For reference, the processing of 10,000 ton/year of food waste in an anaerobic digestion facility is estimated to require about 1 acre of land. Additional land may be required if finished composted material will be stored on site. Excluding land costs, the total capital cost to develop an anaerobic digestion facility would be approximately $500-$700/ton (high capital costs, lower labor costs), totaling $5,000,000 to $7,000,000 for a 10,000 ton/year facility. The annual operating cost is estimated to be between $10 and $20 per ton of food waste. Water utility connections would be required for compost saturation, wash down, and fire control. Sewer utility connections may be required to collect and discharge digester liquid waste. Electrical utility connections would be required for standard building electrical needs. Gas utility connections may be required for supplemental and startup heating needs, but an anaerobic digestion facility could be a net energy producer and could likely be self-powered in the long run. It is estimated that an anaerobic digestion facility would require around three staff per 10,000 ton/year of food waste. These staff would all be qualified operators.

The main advantages of anaerobic digestion is that it requires the least land area of all options, it produces renewable natural gas as a byproduct (so the digestion process can be self-powered), and the process has the lowest environmental impact of all options since burning the resulting methane, either through flaring or for power generation decreases the overall greenhouse gas intensity of the food waste. In addition, an anaerobic digestion facility can accept a wider range of food wastes than other technologies. Food waste may be contaminated, packaged, or otherwise imperfect and still be accepted, assuming upfront depackaging and separation equipment is present.

Some of the disadvantages of anaerobic digestion facility is that is has the second highest initial capital expense of all options, and specially trained staff is required for its operation. Another disadvantage is that the digestate needs to be properly managed, whether for disposal or beneficial reuse.

4.1.4 Hybrid System (Anaerobic Digestion with Composting)

A combined anaerobic digestion and composting process involves the same anaerobic digestion process described in Section 4.1.3, but integrates additional compost processing on the same site to develop fertilizer-grade compost from the anaerobic digester waste. A combined anaerobic digestion and composting is rapidly gaining popularity in the European marketplace out of a need to process compostable non-food materials, such as compostable bags and compostable utensils. A shared location for anaerobic digestion and composting has synergies. Water and methane generated from the anaerobic digestion process can be captured and used in the composting process.

Combination anaerobic digestion with composting has the same input limitations as regular anaerobic digestion, as described in Section 4.1.3.

To process 10,000 ton/year, a combined anaerobic digestion and composting facility is estimated to require about 1.5 acres of land, which includes an area for composting of non-food materials. Additional land may be required if finished composted material will be stored on site. Excluding land costs, the total capital cost to develop a facility for combination anaerobic digestion with composting is approximately $550 - $800/ton, totaling between $5.5M and $8M for a 10,000 ton/year facility. The annual operating cost is estimated to be between $10 and $25 per ton of food waste. Water utility connections would be required for compost saturation, wash down, and fire control. Sewer utility connections may be required to collect and discharge digester liquid waste. Electrical utility connections would be required for standard building electrical needs. Gas utility connections may be required for supplemental and startup heating needs, but an anaerobic digestion facility would be a net energy producer and would likely be self-powered in the long run. It is estimated that an anaerobic digestion facility would require around three qualified staff per 10,000 ton/year of food waste.

Advantages of the hybrid system include all of the advantages of anaerobic digestion technology plus the ability to process compostable materials that may need to be screened from the anaerobic digestion process, such as compostable bags.

The main disadvantages of the hybrid technology are that it has the highest capital expense of all options and specially trained staff is required to operate the anaerobic digestion facility. The hybrid system also has higher land requirements than standalone anaerobic digestion..

4.1.5 Wastewater Treatment Plant Co-Digestion

Food waste can be anaerobically digested in conjunction with municipal wastewater sludge (biosolids) at a wastewater treatment plant, such as a County Water Resource Recovery Facility (WRRF), through a process called co-digestion. The advantage of co-digestion relative to dedicated food waste digestion alone is that existing digesters can be utilized while biogas outputs from the process increase. The operators can manage the co-digestion operation, but additional personnel would be needed to support the entire food waste processing operation.

Adding food waste to the existing digesters increases biogas production with proportionally small increases in required digester volume and digestate (effluent sludge) production rates. In other words, if the total solids loading to the digester increases by 10% as a result of food waste addition, biogas generation will increase by more than 10% and digestate production will increase by less than 10%. This is because food waste has a higher volatile solids (VS) content and is more biodegradable than biosolids.

The biogas produced from co-digestion can be used to generate heat, electricity, or renewable natural gas (RNG) that can offset energy costs for the WRRF. Often, existing digesters at WRRFs use biogas for digester heating, which requires minimal biogas treatment. However, the biogas required to heat digesters is limited, and if food waste is added to the digesters, more biogas may be produced than what is required for heating. Certain energy recovery options may be financially feasible but would require additional biogas cleaning and upgrading equipment. For example, to produce electricity in an engine generator set, the biogas must be purified of hydrogen sulfide (H2S) gas and siloxanes. To produce RNG, carbon dioxide, nitrogen, and oxygen must also be removed. In addition, infrastructure upgrades like electrical upgrades may be required to use renewable energy on- or offsite.

Generally, it is more economically favorable to use the energy produced from biogas onsite than to sell it on the open market. For example, when electricity is consumed onsite, it achieves full market value. If electricity is sold on the grid, a substantial fraction of the sale price may go to the local electric utility, depending on the power purchase agreement (PPA) terms.

When capacity exists at the WRRF, existing digesters can be used to process the food waste slurry, produced through a separate onsite processing operation. Depending on the condition of the digester equipment and the quantity of food waste added, auxiliary equipment upgrades may also be required (e.g. mixers, biogas handling equipment, equalization tanks). If the existing equipment is suitable to handle the increase in feedstock, digestate, and biogas load expected from the addition of food waste, most of the upfront cost is associated with the installation of a food waste-to-slurry processing facility. In terms of operations, the cost increase for the digestion of food slurry in conjunction with biosolids will increase WRRF operational costs associated with digester operation and energy recovery. However, the tipping fees and electricity offsets associated with co-digestion can offset these cost increases, resulting in a net O&M cost decrease.

The digestate produced from co-digestion can be managed in several ways, from landfilling and incineration to land application. Alternatives where the digestate is processed and applied to land (as digestate, compost, pellets, etc.) are considered environmentally beneficial because the carbon and nutrients in the material are used as a soil amendment and can replace chemical fertilizer use. Greenhouse gas (GHG) emissions reductions associated with these practices are discussed in Section 4.2 below.

It is important to note that if the food waste is combined with biosolids as in the co-digestion option, the digestate will be considered a biosolids product that must meet certain requirements for pathogen and vector attraction reduction before it can be beneficially reused under United States Environmental Protection Agency (USEPA) 40 CFR Part 503 regulations and the New York Codes, Rules and Regulations (NYCRR). Per NYCRR 361-3.7, Class A pathogen reduction measures include various combinations of time and temperature treatment (all of which require temperatures of 50°C or higher), composting, chemical fixation (lime addition that causes heat increase), or other forms of special treatment. Pelletization is an alternative to composting that can be built and operated by an outside entity in cooperation with the WRRF. For example, the New England Fertilizer Company (NEFCO) produces a dried pellet product from digested sludge from multiple WRRFs across the country. The pelletized product can be sold or used in municipal applications to offset the purchase of soil amendments. It is noted that biosolids from the wastewater processing may also contain Polyfluoroalkyl Substances (PFAS), a contaminant which is currently unregulated in soil.

Land-applied digestate need only comply with the less stringent Class B pathogen reduction requirements, and for this management option the WWRF must hold a permit for land application. No additional processing of the biosolids beyond mesophilic anaerobic digestion (i.e. digestion at 35°C with a mean cell residence time of 15 days, which is currently practiced at the Peekskill WRRF) would be required.

The total capital cost to develop a co-digestion operation would be approximately \$500 to \$1,000 per ton of food waste received annually (high capital cost). (Note – if the total feedstock mass (including biosolids) is considered, the capital cost is expressed as \$60 to \$110 per ton). The added operating costs to the WRRF are estimated at \$40 to \$90 per ton of food waste. However, if the biogas produced from digestion were converted to electricity, annual operating costs would be offset by renewable energy production, with a net annual revenue between $10 and $30 per ton of food waste (low operational cost). Water and electrical utility connections would be required for the food waste-to-slurry facility, but utilities are typically available at the WRRF. Electrical infrastructure upgrades may be required to use biogas-derived electricity onsite or sell it offsite. A co-digestion operation would generally require one to two additional staff members per 10,000 ton/year of food waste processed. The staff would manage the food waste-to-slurry operation since existing staff at the wastewater treatment facility would manage the co-digestion process. If new auxiliary equipment or processes are added to the existing WRRF operations (for example equipment associated with digestate end use), additional operators and maintenance requirements would be required.

All the advantages of anaerobic digestion would also be realized by co-digestion, including smaller land requirements relative to composting, produce renewable energy, and can take a wide range of food wastes contaminated, packaged, or otherwise. Co-digestion also generates more renewable energy than anaerobic digestion of food waste alone because incorporating biosolids, and results in net operations and maintenance savings relative to standalone anerobic digestion due to leveraging of existing staff and equipment at the WRRF.

Disadvantages of co-digestion would be high capital costs despite offsets of existing infrastructure (because total feedstock volume is large as a result of biosolids inclusion), increased complexity of WRRF operations, need to retrofit the existing WRRF processing system, use limitations on the digested materials, need for specialty trained staff supporting the facility operations.

4.2 Greenhouse Gas Emission Considerations

Greenhouse gas (GHG) emissions evaluations are often performed to assess the contribution of a certain activity to global warming. For the food waste diversion program evaluation, it is important to consider the net GHG emissions associated with each food waste diversion option relative to the baseline scenario. Currently, most of the food waste in Westchester County is combined with MSW and combusted at the Wheelabrator WTE facility in Peekskill, New York. The waste heat from the incineration process is captured to generate electricity, and ash is hauled to a landfill. Options for alternative management of food waste have been reviewed in the previous subsections and include:

- Composting in open windrows
- Composting in-vessel
- Anaerobic digestion
- Anaerobic digestion with digestate composting
- Co-digestion

A significant number of studies in the literature[20] have assessed the GHG emissions of different food waste management alternatives. A few of these compared emissions on a per ton basis for food waste and are summarized in Table 12. Emissions are expressed in carbon dioxide equivalents (CO_2-E). All greenhouse gases are converted to CO_2-E based on their contribution to climate change relative to that of carbon dioxide over a 100-year period.

[20] Oregon Department of Environmental Quality (DEQ); Morris, J. (2014) Evaluation of Climate, Energy, and Soils Impacts of Selected Food Discards Management Systems.

There is consistency between studies on the relative emissions and total emission factor for landfilling food waste with gas collection and utilization. However, the emissions factors and relative rankings vary widely between studies for all the other management strategies. Consider the relative rankings (listed from best, or lowest GHG emissions factor, to worst, or highest GHG emissions factor) of the US Environmental Protection Agency (EPA) Waste Reduction Model (WARM) compared with Moult et al. (2018):

EPA WARM[21]

$$Composting > Anaerobic\ Digestion\ (land\ application) > W2E\ Combustion > Anaerobic\ Digestion\ (composting) > Landfill$$

Moult et al. (2018)[22]

$$Anaerobic\ Digestion > W2E\ Combustion > Composting > Landfill$$

Different values and rankings are calculated by each group because many assumptions go into the accounting of GHG emissions, and the assumptions made by each group will differ. For example, Moult et al. did not take into account the effects of carbon storage activities (i.e. returning carbon in food waste to the soil to promote plant growth and further carbon storage). The EPA WARM does not assume a transportation value and allows the user to input miles traveled for each scenario.

The Oregon DEQ study is a good reference because it aggregated results from 28 selected life cycle assessments out of an original pool of 147 studies. The authors of the study found wide variation between study results, but they adjusted the outputs from each one to define consistent assumptions across the pool, including locally relevant electricity emission factors. This process is called "harmonization". The range of harmonized values developed in this study is shown in the Table 12 – note that the ranges are still very broad. However, the EPA WARM and Moult et al. (2018) study values are within the range of harmonized values for the respective food waste management option.

The Oregon DEQ study authors ultimately concluded that the mean climate impact for anaerobic digestion is statistically lower (i.e. better) than that of composting at a confidence level > 99%. They also determined that the mean climate impact for composting is statistically lower than that of landfilling at a confidence level > 99%. WTE combustion was not considered during this Oregon study.

Emissions factors from available literature give some indication as to the relative GHG emissions from the food waste diversion options considered for Westchester County. However, they do not tell the full story. Location specific factors and ancillary processes impact the net accounting. Some examples are described below.

1. If a composting facility is constructed within the County, some of the yard waste that is currently composted off county could potentially be composted locally instead, which would reduce transportation-related emissions.
2. Co-digestion of food waste with biosolids would result in energy offset-related emissions savings from digesting biosolids in addition to food waste. The co-digestion option may also be associated with a change in end use for digested biosolids, which could increase fertilizer offset- and carbon storage-related emissions associated with the biosolids as well.
3. Transportation-related emissions are extremely site and application specific. In order to understand transportation emissions, one has to understand the quantity of food waste transported, collection routes,

[21] US Environmental Protection Agency (EPA) Waste Reduction Model (WARM) version 15 (2019)

[22] Moult, J.A. et al. (2018) "Greenhouse gas emissions of food waste disposal options for UK retailers." Food Policy. Vol 77 pp 50-58.

processing, final disposal/land application locations, and how particular processing steps impact the volume or mass of food waste.

Woodard & Curran developed a GHG Emissions Model as part of this Study to analyze net GHG emissions relative to a user-defined baseline for the food waste diversion options considered as part of this Study. The model was designed to allow the County to update emissions estimates as the selected food waste management option becomes better defined. Section 7 of this Study provides a summary of the estimated GHG emissions from the various scenarios considered, and *Appendix B – Greenhouse Gas Emissions Model* includes detailed information about the model.

5. CURRENT FOOD WASTE MANAGEMENT PRACTICES

5.1 Residential Food Waste Recycling Participation

In Westchester County, food waste recycling in the residential sector has picked up considerable momentum over the last several years. Based on conversations with the County and various stakeholders, municipal residential food waste recycling in the County seems to have started with a program developed and adopted in the Village of Scarsdale. In the last two years alone, food waste recycling has increased from four municipalities to fifteen today, with that number continuing to increase. As of July 2019, the following municipalities have a food waste (i.e. food scrap) recyling program in place:

- Village of Scarsdale
- Town of Mamaroneck
- Village of Larchmont
- Village of Mamaroneck
- Town of Greenburgh
- Town of Bedford
- Town of New Castle
- Village of Dobbs Ferry
- City of Rye
- Village of Hastings
- Village of Irvington
- Village of Tarrytown
- Village of Sleepy Hollow
- Village of Rye Brook
- Town of Pound Ridge

Critical Success Factors for Implementating Residential Food Waste Recyling Programs in the County

The first step to a successful food waste recycling program is to achieve buy-in from all stakeholders including the residents, volunteer group(s), and the local leaders. A local municipality must be committed from the beginning. They must understand the goals and objectives of the program and be committed to supporting and advancing the program over time to meet the community's growing interest and needs.

The commitment from the community includes the support from local leadership/adminstration (ie. Mayor/Supervisor, Board Members etc.), and having a dedicated staff and volunteer group(s) established to serve as program advocates within the community, all working together to achieve a successful program.

Community engagement involves public outreach to educate community members and promote the benefits of food waste recycling. The outreach is typically achieved by leveraging social media including the municipal website, other media outlets, local public tv, emails, community events, houses of worship, schools, etc. Educating the public about the benefits of food waste recycling will need to be accomplished proactively and consistently in order to effectively build a program. As has been the case with some local communities recently in Westchester County, scheduled public workshops, demonstrations and public forum presentations have helped to engage residents.

Providing instructions through handouts and written guidelines is also an important element of a successful residential program. Acceptable recycling practices, and drop off and collection schedules should be clearly identified to residents. As an example of promoting acceptable recycling practices, some municipalities have developed a very helpful, multi-lingual, brochure that could be helpful for communities that are committed to developing a food waste recyling program.

The community engagement factor is also important to demonstrate to the community that food waste recycling is not difficult. Providing residents with the proper storage apparatus, such as a counter-top pail and a larger storage pail, used for transport to a drop off facility or placed curbside for collection, is also important. As a way to encourage other communities to initiate a recycling program, in the past, the Village of Scarsdale has offered a shared purchasing approach for needed apparatus with other communities as a way to limit expenditures. Purchasing in bulk/large quantities, as part of a shared purchasing arrangement, creates cost savings opportunities.

Another very important element contributing to successful programs is good record keeping in relation to participation. It is important to keep track of those participating members of the community for the purposes of providing adequate storage at the drop off facilities and to develop, as appropriate for certain communties with curbside collection, curb-side pick-up schedules.

When residents decide to participate in the recycling program, having a simple sign-up sheet with the residents' names and email addresses provides a valuable link within the program so that the participants can get email notifications and important updates in virtually real time. This level of recordkeeping allows the local municipality to monitor the growth of the program and to plan for the drop off facility and curbside collection needs. Given the weekly average weight of food waste generated per household, for 4 persons, is 14 pounds, knowing the participation and anticipating growth is a very important metric to have available.

Siting a public facility that is convieniently located is another critical element of a successful program. Convienience is a primary concern that residents have for a drop off site location. Having a site that is welcoming and easy to find is important. Most communities have repurposed a small area within their recycling facility yard to accommodate a drop off site.

Residential Drop-off Facilities

A typical area that is designated for drop-off must be equivalent to about 4 or 5 parking spaces to function well. However, area needs will be dictated by actual food scraps quantities. Food scraps receptacles must have the ability to be freely accessed by the public and also be able to be loaded or "tipped" into a sanitation refuse vehicle or compatable equipment to transport the collected food scraps. The site is typically staffed by a municipal employee who is responsible for assisting the residents, answering questions, organizing the containers, keeping the area clean, assisting with the weekly disposal and providing overall assistance with the purchase of compostable bags and bins for the residents' use. The employees' other important function is to ensure that visible contamination is removed from the material being dropped off. Contamination may include plastic bags, aluminimum foil, plastics, styrofoam and other non-compostable organics .

From a facility schedule perspective, drop-off sites can limit the days and times for collection should there need to be adjustments in personnel or conflicts with other operations at the site, however having the site open to the public full days and on a Saturday seems to work best, as many residents have restrictions during the weekday to drop-off the food scraps. Signage at the facility is also important. Signs need to be visible to the public and have a welcoming and engaging appeal to the public.

The approximate development and operational costs for a residential drop-off site with capacity of up to 50 ton/year includes:

1. Site preparation- varies by site, based on site conditions
2. Signage: $500 to $1,000
3. 32-gallon organic toters @ $125/unit so for 20 units: $2,500
4. Bulk purchase of household containers @ $20/unit
5. Provide a water source for a hose to keep the drop-off site clean
6. Disposal fee- on average at $400/month: $4,800/ year
7. Public handouts, printing, stickers, banners, etc.: $3,000
8. Bulk purchase of compostable bags / liners: $500/ year

5.2 Commercial Food Waste Management

Commercial waste in the County is handled by private haulers under various service arrangements. Typically, food waste and garbage from food service establishments and institutions is collected on site in totes or compactors for pick up and disposal by the contracted hauler.

There are several companies that offer this service in Westchester County, including, but not limited to:

- AAA Carting
- Avid Waste
- Better Carting Service
- Carlo Minuto Carting
- City Carting (Tunnel Hill Partners)
- County Waste Management
- CRP Sanitation
- Oak Ridge Waste & Recycling
- Suburban Carting Co.
- Waste Management

Based on interviews with some of these vendors, City Carting, for example, offers commercial tote service for commercial, institutional, and municipal customers. Food service establishment waste is collected on site in 12, 15, 20, or 30-yard compactors. Grease from food service establishments is collected in 4 or 6-yard containers and handled separately from other food waste.

The City Carting compactors are emptied either on-call or on a pre-determined schedule. The food service establishment waste is taken to the nearest City Carting transfer station where it is mixed with other waste. The waste is then transported to the Peekskill, New York or Bridgeport, Connecticut waste to energy facilities.

In addition to the above traditional private haulers, composting companies are beginning to provide service in the County. Curbside Compost offers commercial tote service for schools, municipalities, markets, restaurants, catering services, cafes, and other food service preparation establishments. They primarily service Fairfield County in Connecticut, but also collect food waste in parts of Westchester County (Armonk, Bedford, Bedford Hills, Cross River, Katonah, North Salem, Port Chester, Pound Ridge, Purchase, Rye, Rye Brook, South Salem, and Waccabuc).

Large waste generators contracting with Curbside Compost receive 32-gallon totes and liners. Food waste is limited to produce, breads and grains, meats and seafood, eggs, dairy, coffee grounds, coffee filters, staple-free tea bags, and cut flowers. Compostable utensils, cups, plates, or paper products are also accepted. The food waste is picked up weekly or bi-weekly schedule, on a predetermined day by location, and hauled to Connecticut to be composted at New England Compost (Danbury) and New Milford Farms (New Milford) or taken to Quantum BioPower's anaerobic digester facility (Southington).

While contracting an additional service like Curbside Compost is an added expense for a food service establishment, it reduces the overall volume and weight of waste that is collected by a traditional private hauler for disposal, which can potentially result in lesser net costs for the management of waste.

6. FOOD WASTE PROCESSING AND RECYCLING FACILITY SOLUTIONS

The solutions presented in this section were developed as County-wide solutions that can be beneficial to all municipalities in Westchester County as an outlet for the processing of their food waste.

In order to develop the proposed solutions, Woodard & Curran completed a vast amount of research, due diligence, and analysis to identify potential opportunities for the co-location of a food waste processing facilities within a County-owned Water Resource Recovery Facility (WRRF) or the Wheelabrator's Waste-to-Energy (WTE) facility in Peekskill, New York. Also, as part of this study, Woodard & Curran completed a preliminary feasibility analysis for the potential development of a large-scale food waste processing facility at the County-owned site known as the "Water Tower" in Valhalla, New York.

The sections below provide a summary of the factors considered as part of our analysis for the selection of the proposed solutions, along with a description of the proposed mid-term solutions, and long-term solution that was identified as part of this Study.

6.1 Factors Considered in the Analysis of Potential Solutions

It is estimated that Westchester County disposes approximately 103,000 and 85,000 tons of food waste per year from the commercial and residential sector, respectively. The combined amount of 188,000 ton/year represents the total food waste that is potentially available for processing and recycling in the County.

Part of the ramp up process for participation in a food waste recycling/processing program includes the need for both the commercial and residential sectors to evaluate their existing infrastructure and what improvements and capital expenditures need to be made in order to support food waste collection, storage, and hauling. Concurrently, there should also be a public engagement/education outreach component to this overall initiative supported by a formal program developed by the County.

In order to develop and recommend solutions for the impending need to recycle food waste, the following factors were considered in the analysis:

Factor 1: Candidate Sites

The original intent of this Study was to evaluate multiple County owned undeveloped properties that could be developed into a food waste recycling facility. Based on coordination with the County, currently one property was identified that could potentially be developed in the future for food waste recycling. That property is located in Mount Pleasant, New York (east to the Westchester County Medical Center in Valhalla, NY). This site is referred to as the "Water Tower Site" due to the presence of a water tower in the property.

Since currently a single property was identified by the County as a potential site to host a standalone food waste processing facility, various scenarios were evaluated for the implementation of different food waste processing technologies. Proximity to residential areas, site access, utilities, environmental constraints, permitting, easement and site constraints, and site development costs were all considered in the evaluation.

Although this Study focused on the Water Tower Site, the analysis provided can be used as a guide to evaluate additional sites within the County as they are identified going forward.

Factor 2: Food Waste Processing Technology

Each food waste processing technology has pros and cons that bear different weight depending on the context of the analysis. For example, small footprint requirements for a given technology is a strong positive in

Westchester County where undeveloped land is scarce and costly to acquire. Also, the concern with odors, noise, and vectors vary across the various food waste processing technologies.

As part of this Study, commonly used food waste recycling technologies (i.e. open windrows, in-vessel composting, AD, combination AD and composting, and wastewater treatment co-digestion) were considered in the analysis for the development of a recommendation.

Factor 3: Capital and Operational Costs

Capital costs and operational costs also play a key role in the selection of a recommended technology for the processing of food waste. Generally, technologies with the higher capital costs have lesser staff needs and run on lower operational costs.

Also, the ability to retrofit and leverage the use of the existing Water Resource Recovery facilities (WRRF) in Westchester County for the processing of food waste typically yield higher benefit-cost ratios.

Factor 4: Implementation Schedule

Given the interest in a short-term solution, the required time to move a project forward also plays an important role in the analysis. For this Study, several options were considered for a phased approach. It should be noted that once a food waste recycling program is established and a processing facility(ies) is operational, all of the estimated tonnage will not be directed to recycling facilities immediately.

On the commercial side, with the NYS Food Donation and Food Scraps Recycling Act, the Commercial sector (i.e. large Commercial food waste generators, greater than 2 tons per week) will not be required to deliver food waste to a recycling facility until January 2022, provided there is a permitted facility within a 25-mile radius. From a practical standpoint, the County will not have a facility or multiple facilities with sufficient capacity to support all large generators of commercial food waste, operational and within a 25-mile radius of all commercial establishments by January 2022. Similarly, the County should expect that there will be a need for some portion of the food waste generated by the residential sector to require disposal as well, with that need also increasing over time as residential voluntary drop-off and collection practices and programs become more common and successful. It is expected that the County will move towards a phased approach to sequence in facilities over time, perhaps leveraging multiple technologies at various locations as the County monitors the success of newly operational facilities and as budget allows.

Factor 5: Community Engagement

Community input gathered through meetings with the group of stakeholders and the public forum open to all County residents was also critical for the development of a recommended solution(s) for food waste processing at the County. Many of the public concerns, such as carbon footprint, quality of the end-product, hauling of the food waste, and acceptance of food waste types, and previous experience in the permitting of a food processing facility were also considered in the analysis.

Based on input gathered through the stakeholder meetings, there seems to be a generalized preference from the public for the implementation of smaller-scale local food waste processing facilities within the County, at the various municipalities. This approach would reduce transportation needs and would theoretically reduce net GHG emissions. However, previous experience shows that available space is very limited within the County, generally local communities are concerned with environmental impacts, and securing local permits for a food waste processing facility has proven to be problematic (refer to example discussed at SS#2).

6.2 Mid-Term Solutions

6.2.1 Co-Digestion at Peekskill's WRRF

Westchester County operates seven Water Resource Recovery Facilities (WRRFs) across the County. Based on conversations with the County, the location with the greatest potential for available space for a food waste processing operation is the Peekskill WRRF. Based on a field inspection, it appears that there is approximately 1 acre to the south of the facility available and a smaller parcel to the west. The overall WRRF site is in a somewhat remote area not near any residential homes or other sensitive receptors. The parcel to the south has the potential to host a small food waste processing plant with capacity to convert 10,000 ton/year of food waste into food waste slurry. The property to the west could be used as additional site storage to support the operations.

For this scenario, we would recommend co-locating a food waste processing facility at the Peekskill WRRF. The food waste processing facility would receive the food waste, remove contaminants, grind, and ultimately slurry the material with dilution water (could be WRRF effluent) to generate a blended, pumpable mixture with 10 to 15% solids content. Ideally, the slurry would be pumped from the facility site to the digester site; however, hauling is also an option. A detailed analysis of the existing WRRF equipment and overall design would be necessary to specifically understand what retrofits may be needed to the existing WRRF to accept the slurry, and what limitations may exist related to the acceptable quality of the food waste slurry.

Co-location, instead of siting the food waste processing facility at a nearby or adjacent site, is advantageous for couple reasons. First, materials can be easily transferred between the food processing facility and the WRRF, including the slurried feedstock, WRRF effluent (if used for dilution water), and renewable energy. Second, the food waste processing facility would be able to utilize existing infrastructure at the WRRF including utilities, roadways, lighting, and fencing.

The food waste processing facility could be operated by the WRRF (see discussion of new operations staff requirements below) or by a private entity. Under the latter scenario, the private entity would take on the responsibilities of operating the food waste processing facility and in return would earn the tipping fees for the food waste stream or a portion thereof depending on terms negotiated with the County. If the facility were at the Peekskill WRRF and the digester biogas were used to generate electricity, renewable natural gas (RNG), and/or heat, the WRRF may also be able to offer reduced energy rates to the private entity as well.

Co-location and discharging to a nearby WRRF digester are not new concepts, and similar approaches have been adopted by other municipalities, including North Andover, Massachusetts and Utica, New York. The Greater Lawrence Sanitary District (GLSD) in North Andover, Massachusetts is a WRRF that recently began co-digestion operations and has an arrangement with Waste Management. Waste Management operates a food waste processing facility in Charlestown, Boston, Massachusetts that produces a slurried food waste product which is hauled to North Andover in 3 to 4 truckloads per day. Waste Management earns the majority of the tipping fee for providing this service. Another example of co-digestion at an existing WRRF is the Public/Private Partnership between Waste Management and New York City for the Newtown Creek WRRF. For that facility, Waste Management accepts about 250 tons per day of food waste at their food waste processing facility located less than 5 miles from Newtown Creek. Once the food waste is processed into a slurry it is transported in a 185,000-gallon equalization tank to the Newtown Creek facility. Newtown Creek has sufficient capacity in their digesters to accept the slurry. At Newtown Creek there are 8 digesters, with 4 of them (the North Battery) made available for acceptance of the food waste slurry. Currently gas generated from the digesters is flared. The City has plans to move the project from a demonstration phase to a permanent facility which will include an increase in incoming food waste tonnage.

In Utica, the Oneida-Herkimer Solid Waste Authority (OHSWA) partnered with the Oneida County Sewer District (OCSD) who recently upgraded their Water Pollution Control Plant (WPCP), including 2 new anaerobic digesters. There is an existing recycling facility adjacent to the Plant, which was also recently expanded to include a depackaging system for food waste. Food waste is processed into a slurry product which is pumped into a holding tank to allow for flow equalization, and it is then pumped at a constant rate to the existing anaerobic digester at the WPCP. The depackaging system was designed for a maximum of 22,000 ton/year of food waste. The basis of design was a result of commercial waste generation estimates. The new food waste processing facility is currently processing about 2,000 ton/year and they intend to ramp up over the next 5 years to at least 5,000 ton/year. The retrofits added to the transfer station operation cost about $3.5M and sit on about 2 acres. As indicated, OHSWA expects to ramp up with the incoming food waste quantity over time. Many of the commercial establishments are currently evaluating their own infrastructure to determine what improvements are needed to store, loadout and haul the food waste out in order to comply with NYS Food Donation and Food Scraps Recycling Act by January 2022. The tip fee for the food waste is approximately $40/ton while the tip fee for MSW at $62/ton. OHSWA does offer residential drop off; however, minimal residential food waste is currently being delivered to the OHSWA facility.

Under our proposed mid-term solution, a food waste processing plant adjacent to or on-site at the Peekskill WRRF would process 10,000 ton/year of food waste and blend it with dilution water to generate 4.4 million gallons/year (12,000 gallons/day) of food waste. However, the required volume of dilution water could vary based on the variety and types of food waste accepted. The slurry would be stored in an equalization or holding tank and then pumped or hauled to the WRRF digesters.

There are two 168,000 cubic foot (cf, 1,170,000 gallon) digesters at the Peekskill WRRF. It is our understanding that one of the digesters ("primary") is currently used for anaerobic digestion, and the other ("secondary") is used to gravity thicken the digestate. The secondary digester is unmixed; decant is removed regularly and settled sludge is hauled offsite at 2 to 3% solids content. Settled digestate is incinerated at a Veolia-operated incinerator in Naugatuck, CT. Recent upgrades at the Peekskill WRRF have included modifications that would allow either digester to operate as the primary or secondary digester. However, it would be cost prohibitive to eliminate the use of one digester for thickening, because the volume of hauled digestate would increase substantially. Therefore, we have assessed the capacity of the Peekskill digesters by assuming that no digestion processes will occur in the secondary digester. This is a conservative assumption, since anaerobic digestion processes will continue at a slower rate in the secondary digester.

Table 13 summarizes the digester operating parameters and estimates of biogas production as well as electricity generation under current and future conditions with biosolids feedstock only, and under future conditions with combined biosolids and 10,000 ton/year food waste feedstock. Future conditions (2030) take a modest annual population growth rate of 0.5% into account.

Industry standards recommend a minimum 15-day sludge retention time (SRT) and maximum 0.20 lb/cf/day volatile solids (VS) loading rate under design conditions. At future maximum month (i.e. design) conditions, the maximum food waste capacity of the Peekskill digesters is approximately 13,000 ton/year. VS loading is the limiting condition. Under the conditions of slurrying 10,000 ton/year of food waste into a 4.4 million gallons/year, the average day SRT would decrease from 31 days currently to 20 days. Similarly, the volatile solids (VS) loading rate would increase from 0.047 lb VS/cf/day to 0.14 lb VS/cf/day.

If it were desirable to increase the food waste loading to the Peekskill digesters in the future, thickening or dewatering equipment could be added to free up the second digester and allow the digesters to operate as a High-Rate Two Stage anaerobic digestion process. Under these conditions, the Peekskill digester capacity would increase to approximately 34,000 ton/year. It would need to be confirmed with the WRRF whether space exists for the additional equipment before expansion could be considered further.

Several types of capital upgrades would be required to allow the Peekskill WRRF to begin to accept food waste for co-digestion. We expect that the majority of the upfront capital investment would go into the development of the food waste processing facility equipped to receive, de-package and process the food waste. The required equipment would include truck scales, screening and grinding equipment, pumps, holding tanks, odor control, and an equalization tank for slurried food waste to ensure a stable feed to the digesters. The slurried food waste could be piped directly from the food waste processing facility site to the digester site, with the equalization tank sited at either location. There is an existing access road, and on-site utilities, and the site under consideration is cleared, which all help control overall development costs. The total project cost for these items is estimated to be in the range of $3.5 to $5M.

Other significant retrofits would be associated with biogas treatment, and energy recovery equipment. Currently, the biogas collected at the Peekskill WRRF is either flared or used to power a dual-fuel boiler for digester heating. The increase in biogas generation rates would exceed the heating requirements of the boiler. Therefore, the excess biogas generated from the food waste would be flared unless energy recovery equipment was put into place. Based on feedback from stakeholder meetings, there is support for making beneficial use of the biogas generated from food waste.

Combined heat and power (CHP) generation with an engine generator set is one option for biogas utilization. Electricity can be captured and used to offset WRRF electricity consumption, while waste heat is captured and used to heat the digesters. The biogas would also need to be treated to remove hydrogen sulfide gas and siloxanes. The engine generator and treatment equipment packages would cost on the order of $1.5M. Although energy recovery equipment is expensive, it is essential to achieve net greenhouse gas emission savings and net revenues from the project. There may be options for staging in the installation of energy recovery equipment to reduce upfront costs.

The current electricity consumption of the Peekskill WRRF was not available for this Report, but we expect that the electricity generated from co-digestion of biosolids with 10,000 ton/year of food waste would not be enough to offset all facility energy requirements. Therefore, all of the electricity generated from biogas could be consumed onsite. If electricity generation exceeded plant requirements, or if the WRRF were interested in selling electricity on the grid during periods of low on-site electricity consumption, it may be possible to come to an agreement (i.e. a power purchase agreement) with the local electrical utility. Regardless of whether the electricity is used onsite, offsite, or both, electrical infrastructure upgrades may be required. Evaluation of these costs would require a more detailed assessment of existing infrastructure.

Adding 10,000 ton/year of feedstock to the Peekskill digester will significantly increase the flows and loads to the existing digester, as well as the digestate and biogas produced by the digester, as summarized in Table 14. The existing WRRF, including existing pumps, mixers, heaters, and biogas handling equipment, would need to be further evaluated to design the appropriate retrofits. For example, adding food waste to the Peekskill digesters is expected to increase the average biogas generation rates by 80 to over 200%. The biogas safety equipment and piping must be evaluated for its ability to safely and effectively convey the increased biogas flow rates. A detailed study of the plant will help to understand plant dynamics for hydraulic and biological treatment capacity. In addition, the secondary digester supernatant flow and loads of organics and nutrients may increase as a result of food waste co-digestion. A more detailed analysis would be required to assess the impacts of this flow on liquid-side WRRF operations.

The addition of food waste to the digesters will also increase operational costs at the plant. From an operational perspective, one to two full time staff members will be needed for the food waste-to-slurry processing facility, and it is assumed that existing staff at the WRRF can manage the co-digestion process. However, if new auxiliary equipment or processes are added to the existing WRRF operations, additional operators and maintenance requirements may be required. The requirement for additional WRRF operations staff would need to be evaluated at a later stage of design.

Other operating costs that would be expected to increase include:

1. Digestate management costs will increase proportionally with the increase in digestate production. If the management option for the digestate changes as well, this would further influence operating costs.
2. Odor scrubbing costs, for example chemical costs associated with a chemical odor scrubbing process.

3. Biogas cleaning costs associated with removing contaminants from the biogas, as reviewed above.
4. Electricity costs associated with new equipment.
5. Plant maintenance associated with new equipment.

There is stakeholder support for beneficial reuse of combined biosolids and food waste digestate product if food waste is managed at the Peekskill WRRF. The Westchester County Department of Environmental Facilities reports that the digestate is currently hauled to a waste-to-energy (WTE) incinerator in Naugatuck, CT at a price of $0.093 per gallon. This is beneficial reuse in terms of renewable electricity generation. However, if there is demand to use the digestate as a soil amendment, the digestate can be land applied as a Class B product or upgraded to produce a Class A compost or pelletized product. In both cases, the gravity thickened digestate could be hauled and managed offsite by a privately-owned and operated facility that would take responsibility for processing and handling. The end use of the biosolids will impact the disposal cost. Typically, land application costs are dependent on the hauling distance. A facility generating Class A compost or pellets could be developed through a public-private partnership, similar to the food waste processing facility. A key consideration with disposal and possible reuse/recycling includes the overall quality of the digestate including potential concerns with Polyfluoroalkyl Substances (PFAS) concentrations originating from the wastewater.

If energy recovery processes are put into place alongside the addition of food waste to the digesters, and the project receives tipping fees for the food waste, total project revenues are expected to offset the operational cost increases. Table 15 shows an example of how revenues could offset added expenses and result in a net income of $10 to $30 per ton of food waste received. The values in the table should be considered an example until unit costs for this scenario can be determined or better estimated.

As previously stated, extensive due diligence would need to be performed on the current WRRF digesters' ability to handle the projected additional load, as well as impacts on the WRRF liquid side treatment operations. This is a critical factor in establishing project costs and the overall feasibility of introducing the food waste slurry into the WRRF digester and determining what retrofits would be required. However, a rough range of anticipated cost would be somewhere between $6M and $8M for construction and equipment in this solution.

Refer to Figure 6 – WWRF Co-Digestion Site for site location.

6.2.2 Anaerobic Digester Co-Location at Peekskill's Wheelabrator WTE Facility

Similar to co-location of a food waste processing operation near a WRRF, there are many benefits to co-locating a food waste processing facility at an existing WTE facility. Westchester County has a waste-to-energy (WTE) facility that is currently operated by Wheelabrator (RESCO Facility) in Peekskill, NY. Based on discussions with the operators and a review of existing maps, there is about 0.75 acres to the north of the plant that may be able to accommodate a small anaerobic digestion facility considering there is existing infrastructure that could be utilized this facility. There may be other open space areas that require further investigation and discussion with Wheelabrator to understand whether they would be available for digesters or food waste processing operations. Given the limited area on site that seems to be available, the anaerobic digester facility would likely have a capacity of 10,000 ton/year or less.

Table 16 summarizes the inputs and outputs for a digester co-located at the Wheelabrator facility. Note that these are consistent with the inputs and outputs associated with food waste for the mid-term co-digestion option summarized in Section 6.2.1.

Given that the site is currently accepting solid waste, infrastructure is in place for truck/vehicle traffic flow, including access roads, scales, and utilities. Logistics are already established with the hauling community for deliveries to the site. Furthermore, there are operating permits currently in place (solid waste and air permits with the NYSDEC) which may streamline the siting and overall permitting process for a food waste processing and anaerobic digestion facility. There are other synergies as well, including:

- Digester water can be used at the incinerator for cooling.
- Steam from the incinerator facility can be used to heat the digester(s).
- If the biogas generated from digestion is used to produce renewable electricity, the electricity can be used to offset parasitic loads from the incinerator facility, and excess can be distributed to the grid via the existing interconnection at the incinerator site.

Also, similar to co-locating near the WRRF, the idea to co-locate near an existing WTE facility is in the spirit of an "eco-park" type concept where one site has the ability to receive waste materials from the MSW stream and then direct the incoming waste either towards digestion or the RESCO facility for combustion.

The key factors that would go into establishing a budget estimate for building a food waste processing facility with anaerobic digesters at the WTE facility site are related to existing site conditions (subsurface utilities, site grading and stormwater management) and site connections for electricity, steam, and digester water. A rough range of anticipated cost would be somewhere between $5M and $7M for construction and equipment. This assumes a food waste processing facility with a maximum capacity of 10,000 ton/year.

From an operational perspective, three full time staff members would be needed to run the anerobic digestion operation. Between labor and utilities, it is estimated that the cost to operate the facility will be approximately $10 to $20 per ton of food waste processed.

It should be noted that given Wheelabrator is under contract with the County to operate the WTE facility, it is possible Wheelabrator could move ahead with a potential solution independent of the County.

Refer to Figure 7 – Wheelabrator Anaerobic Digester Site for site location and refer to Table 17 for a comparison between the two mid-term solutions under consideration.

6.3 Long-Term Solution

6.3.1 Development of County Owned Property

Based on coordination with the County, the only County-owned property that was identified at the time of issuance of this Report that is potentially available to develop a stand-alone food waste recycling/processing facility is the property located at 145 Bradhurst Avenue in Valhalla, NY, near the existing County water tower, which is also near the proposed North Sixty development project, a proposed biotech center with medical offices, restaurants, shops and hotel. This section provides an initial review, considerations, and recommendations for a more permanent, longer term food waste recycling/processing solution as it relates to this property.

According to Town of Mount Pleasant tax maps, this parcel is owned by the County and referred to as the Grasslands Reservation, which consists of a calculated acreage of 46.74 acres. A City of New York Department of Water Supply easement associated with the Catskill Aqueduct transects the site in the north leaving a calculated 13.23 acres to the north of the easement and a calculated 33.51 acres to the south of the easement. In addition, tax maps identify the approximate location of a subterranean easement transecting the parcel towards the south, associated with the Delaware Aqueduct. Aboveground electrical transmission lines are also present within the northern Catskill Aqueduct easement. Refer to Figure 8 – Water Tower Site for site location and easements.

This parcel consists of primarily undeveloped land with the exception of the County water tower and an existing access road to the water tower. Approximately 14.5 acres of the total area falls outside of designated steep slopes (with steep slopes defined as >15% slope). In addition, Westchester County GIS Interactive Mapping database identifies the location of wetlands present on and adjacent to the property. Refer to Figure 9 - Environmental Constraints.

Based on the United States Department of Agriculture, Natural Resources Conservation Service Web Soil Survey, the property at 145 Bradhurst Avenue is predominately composed of Paxton fine sandy loam, 8 to 15 percent slopes, and Paxton fine sandy loam, 3 to 8 percent slopes. These soils are defined as well-drained soils with shallow depths to restrictive features and water table (approximately 18 inches to 37+ inches depth for both). The site is listed as hydrologic soil group C.

As noted above, the anticipated total acreage available for development of the proposed food waste recycling/processing facility is approximately 14.5 acres. Considering site constraints, including the existing topography of the site, its proximity to residential areas, and the presence of downstream environmentally sensitive areas, an anaerobic digester facility would be the more feasible option for a large-scale operation at this site given the smaller footprint requirement, and low odor and operational noise associated with this technology. The open windrow approach would require greater site development and has more potential for environmental impacts given the outdoor operations, including the need to control odor, vectors, and stormwater. In addition, for reference, a target processing capacity of 60,000 ton/year would require approximately 4 acres of land for anaerobic digestion, compared to about 20 acres of land required for open windrow composting. Another advantage of an anerobic digester facility is its ability to expand on this property over time, based on future processing needs.

For the purposes of this preliminary analysis, grading software was utilized to develop and assess several preliminary site layouts considering the implementation of an anaerobic digester facility. Refer to Figures 10, 11 and 12 labelled Anaerobic Digester Facility Conceptual Site Layout 1, 2 and 3, respectively, identifying three different preliminary conceptual layout options for siting the anaerobic digester food waste recycling operation on the property. Layout 1 consists of constructing the facility to the far northern portion of the site. Layout 2 includes constructing the facility in the middle of the site but concentrated to the east of the property. Layout 3 includes constructing the facility spanning across the majority of the middle portion of the site. The site layout will need to be further developed and revised as the scope of the facility is refined throughout the planning and design development process.

The development of the subject site to accommodate a functional anaerobic digester facility would require significant sitework (i.e. clearing, grading, stormwater quality treatment and flow attenuation, subsurface utilities, retaining walls, landscaping, etc.) for the installation of access roadways, scale(s), parking, staging, and the processing building and support systems. It is estimated that on the order of 10,000 to 30,000 cubic yards of earthwork would be necessary for development of the site. This volume is highly dependent upon, but not limited to, the final scope and scale of the facility and its operations, the ability to balance the earthwork on-site, and results of site investigations as it relates to subsurface conditions (i.e. groundwater, bedrock, etc.) and other similar type site constraints.

A 60,000 ton/year food waste operation might expect to generate on the order of 20 to 30 cubic yards of humus type byproduct per day. This material may be staged on-site for incorporation into compost and soil amendments and/or exported for processing elsewhere. How this step of the operation is managed will have a significant impact on the size and layout of the facility. It would be expected that the footprint of the facility would grow beyond the estimated four acres if a significant amount of on-site staging and processing of byproduct were to take place.

In terms of site layout constraints for any proposed development, further coordination will be necessary as it relates to construction and facility operations in proximity to the Catskill and Delaware Aqueduct easements. It is expected that the facility construction would be concentrated within the area outside of steep slopes and between the referenced easements. Several preliminary site layout and grading options have been generated to obtain a relative sense for scale and disturbance of the operation, where pros and cons exist for each option when considering proximity to easements and existing utilities, earthwork, truck access and maneuverability, flexibility for future expansion, extension of utility services, etc.

As it relates to increased truck traffic and site access, it is estimated that a 60,000 ton/year anaerobic digester food waste recycling operation would receive food waste from an estimated 5 to 15 trucks per day, averaging an estimated 200 to 250 tons per day. It is anticipated that at a minimum, there will be a need to widen and realign the existing entrance at Bradhurst Avenue (NYS Route 100) and reconstruct the existing access road in order to support increased vehicular truck traffic. Considering Bradhurst Avenue is a State road, planning and design coordination with the NYSDOT is anticipated and should commence early on in the planning process.

In terms of utilities, it is anticipated that the proposed facility would require utility services and site infrastructure for water, sanitary sewer stormwater, electric, data, and natural gas, where natural gas is more likely only needed for start-up of operations.

According to the *Major Water Suppliers* map generated by the Westchester County Department of Planning in 2015, the proposed site is not located within any water district in Westchester County. Further research on the Westchester County Geographic Systems (GIS) environmental mapper indicated that the nearest water district to the site is the Westchester County Water District #3. One of the following options may be considered to provide water service to the proposed facility:

1. The County may request to become an out-of-district customer of Westchester County Water District #3
2. The County may expand the limits of Westchester County Water District #3 to include the parcel; or
3. The County may develop an on-site water supply to service the facility (i.e. wells).

In terms of sanitary sewer requirements, it is estimated that an anaerobic digester facility could generate on the order of 11 to 13 million gallons of wastewater discharge annually (or 30,000 to 36,000 GPD). On-site wastewater disposal is not recommended (given site topography, use, and anticipated flows). It is recommended that wastewater is routed off-site towards an established sewer district. Based on the Westchester County GIS environmental mapper, the proposed site is located within the Saw Mill Sewer District and could be supplied via a new sewer connection.

Ideally, the anticipated flows would be routed via gravity by extending a new sewer service into the site and installing new sewer main along Bradhurst Avenue, dependent upon the condition and capacity of the existing sanitary sewer system in proximity to the proposed project site. A pump station may be required, but not a concern given the anticipated wastewater flows. We recommend that a more detailed analysis be completed as it relates to sanitary sewer utility service as part of a formal feasibility study for the site.

Stormwater infrastructure would be expected to include stormwater quality treatment, post-development flow attenuation, and associated collection and conveyance infrastructure. The parcel being considered is located within the Bronx River Basin watershed, outside the NYCDEP East of Hudson watershed. As stated in Section 7.3.2, the existing soils at the property are characterized by shallow depths to the water table. Regarding stormwater management, standard water quality treatment practices such as infiltration practices or bioretention practices which require separation to groundwater or bedrock (4 feet and 2 feet, respectively), may not be feasible practices to treat stormwater at the site. Formal site investigations and testing will be required to further assess whether subsurface infiltration practices are feasible. Additionally, further analysis of above-ground systems or underground retention and detention systems, which do not credit infiltration, may be necessary to provide adequate stormwater management of the proposed site to meet NY State stormwater permitting requirements while balancing intended site operations and considering future facility expansion.

Electrical service will be required for an anaerobic digester operation at the site. Electrical utilities exist along Bradhurst Avenue. Special electrical service requirements are not expected to be needed to service this facility and final electrical utility service layout and coordination will occur with ConEdison.

Natural gas distribution will also be required at the facility, primarily needed for the startup of operations, but the gas demand to power the facility can eventually be supplied by the biogas production associated with the anaerobic digestion process. Final natural gas utility service layout and coordination will occur with ConEdison.

In the case of the sale of electricity and/or natural gas back to the grid, additional coordination will be required with ConEdison to verify viability in this specific instance.

A preliminary range of the anticipated cost to develop a 60,000 ton/year anaerobic digester facility at the site would be in the range of $25M to $35M, with higher costs required if parallel composting or on-site storage is desired. The facility could be operated by a staff of 12 employees trained for digester operations. The operational cost is anticipated in the range of $10 to $20 per ton of food waste processed.

There is the potential to offset costs or generate net revenue by recognizing surplus energy generation from electricity and/or natural gas. The amount of electricity and natural gas generation will vary dependent upon the scope and scale of the proposed operation. At the Southington Quantum Biopower anaerobic digester food waste processing facility for example, the methane that the facility generates in operations can be used to generate electricity, vehicle fuels, or pipeline gas where upwards of 80% of the gas produced is monetized in the form of electricity generation.

In addition to the energy generation, there is opportunity to offset operation costs by reusing the digested products from the anaerobic digestion process. According to the United Stated Environmental Protection Agency, these digested products can be processed into fertilizer, compost, soil amendments, or animal bedding.

The overall planning, design, and permitting of a 60,000 ton/year anaerobic digester facility at the subject site may take on the order of 18 to 24 months, with a portion of the design and permitting occurring concurrently. Construction is preliminarily estimated to take about 22 months for a total implementation timeframe of approximately 48 months for this solution. However, actual timeframes will depend on the final scope of work for the project.

Based on total acreage available, the site may be able to accommodate a considerable-sized food waste recycling facility. A reasonable target for initial processing capacity would be 60,000 ton/year, considering the estimated quantities of food waste generated in the County and anticipated recovery rates and ramp up times.

It should be noted that while the Mt. Pleasant location may be an option, a more formal and extensive feasibility study would need to be completed to further evaluate and verify the suitability of the proposed site to host large-scale food waste processing operations. To date, no detailed investigation into the availability or feasibility of using this property has been undertaken. Additionally, the County is undertaking a search for other potential candidate sites that could be developed in the future to accommodate a food scraps recycling facility.

Figure 13 shows the location of the solutions identified in this section. Figures 14, 15 and 16 show the area within a 25-mile radius from the location of these solutions. Per the New York's Food Donation and Food Scraps Recycling Act (effective January 2022), large commercial food waste generators (i.e. generating more than 2 ton/week) will be required to divert inedible food to a food waste recycling facility that is located within 25 miles.

It should be noted that municipalities may undertake their own food scraps recycling programs as a localized small-scale alternative. While these localized small-scale operations should not be considered by Westchester County as a County-wide solution, they may be attractive for a private business or municipality.

Currently, there are vendors who accept food waste for composting using various technologies with the most typical being open windrow or mass bed, both which require significant acreage. Within Westchester County, Sustainable Materials Management, Inc, is permitted as a composting facility in the Town of Cortlandt, NY, to recycle organic waste including food waste and leaf and yard waste, once operational. This facility in particular utilizes about 4 acres of land and is currently permitted to compost 5,000 ton/year of food waste.

Small scale anerobic digesters are also offered in the marketplace. These units require a small footprint and may be suitable as a localized solution in Westchester County, where the cost of land is high and odors, vectors and noise from a facility operation are a concern due to the presence of densely populated areas throughout the County.

7. GREENHOUSE GAS EMISSIONS ANALYSIS

Woodard & Curran developed a greenhouse gas (GHG) emissions model to estimate the relative GHG emissions of several food waste management options that the County is currently considering, including various types of composting, anaerobic digestion, and combinations of the two practices. The model has been designed to allow the County to update the GHG emissions estimates as the project evolves, and conditions become more certain.

The GHG model outputs depend on many variables, including inputs related to the energy efficiency of existing facilities, including the Wheelabrator waste to energy (WTE) facility and the Peekskill water resource recovery facility (WRRF). Some of these input parameters are currently based on assumptions and should be verified as needed before drawing final conclusions from the model calculations. Critical inputs in the model are summarized in *Appendix B – Greenhouse Gas Emissions Model*.

The GHG model organization, calculation methods, assumptions, limitations, user guide, and other important considerations are included in this report. The model calculations for food waste and yard trimmings are largely based on the US Environmental Protection Agency (EPA) Waste Reduction Model (WARM) version 15. Calculations for biosolids are based primarily on the Biosolids Emissions Assessment Model (BEAM) version 1.1. The County model is therefore a blend of existing models. Where required, professional judgment and reference to industry literature has been applied to combine these two models. The resulting blended model is customized specifically for application in Westchester County. *Appendix B – Greenhouse Gas Emissions Model* describes the methodology and calculations used in the model.

Appendix B also includes a discussion of the uncertainties associated with modeling GHG emissions. In particular, nitrous oxide (N_2O, a greenhouse gas) emissions and carbon sequestration are dependent on application conditions, and their values are very sensitive to the overall GHG emissions calculations. Understanding the various ways that application conditions can affect emissions can help the County design management strategies with the lowest possible GHG emissions.

As a process, based on results from the GHG analysis, the current practice of food waste combustion for WTE generation has the second lowest GHG emissions after anaerobic digestion with land application of digestate. Open windrow composting and anaerobic digestion with WTE combustion or composting of digestate have very similar GHG emissions, and in vessel composting has the highest GHG emissions. Below is a summary of the results for the food waste management options considered in the model. Options are ranked from lowest GHG emissions to highest, with negative emissions representing net GHG emissions offsets:

1. Anaerobic digestion or codigestion with land application of digestate — -155 kg CO_2-E/ton
2. WTE — -125 kg CO_2-E/ton
3. Open windrow composting - local — -95 kg CO_2-E/ton
4. Anaerobic digestion or codigestion with WTE combustion of digestate — -83 to -89 kg CO_2-E/ton
5. Anaerobic digestion or codigestion with composting of digestate — -83 to -88 kg CO_2-E/ton
6. In vessel composting - local — -69 kg CO_2-E/ton

However, it is important to note that the model outputs for the various food waste management options should not be used alone to identify the practice with the lowest overall GHG emissions, because none of the options would be implemented in a vacuum. For example, if food waste is composted locally, then we can estimate that 10,000 tons/year of yard waste would also be composted locally at the same facility instead of at remote locations. Similarly, if food waste is co-digested at the Peekskill WRRF with biosolids, energy recovery from biosolids-derived biogas would also be improved.

For a more realistic analysis, the model also compares the net GHG emissions for five potential scenarios, which are combinations of different feedstock management options, with the current baseline scenario. Note that none of the scenarios include land application of biosolids; we have assumed that biosolids cannot be land applied in any form, either in state or out of state. In the baseline scenario, "recovered" food waste (i.e. food waste diverted from the Wheelabrator WTE facility, is composted remotely in open windrows at the Ulster County Resource Recovery Agency (UCRRA), while all yard trimmings are composted remotely in open windrows at various remote composting facilities. Biosolids are digested and biogas is used for heat recovery only. All the scenarios assume the same total quantities of each feedstock to estimate total scenario emissions. Below is a summary of the various scenario rankings from the analysis, shown from lowest to highest:

1. Co-Digestion at Peekskill WRRF with digestate WTE (scenario 5) -950 Mg CO_2-E/yr
2. Local open windrow composting (scenario 1) -660 Mg CO_2-E/yr
3. Anaerobic Digestion at Wheelabrator with digestate WTE (scenario 3) -170 Mg CO_2-E/yr
4. Anaerobic Digestion at Wheelabrator with digestate composting (scenario 4) -160 Mg CO_2-E/yr
5. Baseline (current scenario) 0 Mg CO_2-E/yr
6. Local in vessel composting (scenario 2) +220 Mg CO_2-E/yr

Note that the net GHG emissions for the baseline scenario are zero because all net emissions are calculated relative to the baseline. The scenario with the lowest net GHG emissions involves co-digestion of food waste with biosolids at the Peekskill WRRF, with combustion of the digestate at the Veolia Naugatuck, WTE facility, which is the current practice with biosolids digestate from the Peekskill WRRF. All scenarios have lower emissions than the baseline except for Scenario 2, in which food waste and yard trimmings are composted in vessel. Model findings are presented in more detail in *Appendix B – Greenhouse Gas Emissions Model.*

It should be recognized that GHG emissions analyses consider a specific environmental benefit of waste management options: the relative contribution to global warming as a result of direct and indirect GHG emissions. GHG emissions analyses do not capture the full environmental benefits of a particular practice. For example, land application of compost and digestate improve soil fertility and productivity, protect water quality, and provide a range of other ecosystem services that are not quantified by GHG emissions analysis. The analysis also does not account for emissions of non-GHG gases or other types of soil or water pollutants into the environment.

Pending interpretation of the Food Scraps Recycling Law by NYSDEC as the regulatory agency responsible for enforcement, at minimum, the GHG numbers would be altered by the inability to use the WTE plant to process digestate derived in part from food scrap processing. Furthermore, depending on the interpretation, due to the likelihood of PFAS in biosolids, land application of digestate from co-digestion with biosolids from a WRRF could potentially result in PFAS contamination of the land upon which it was applied, complicating the use of co-digestion as a food scrap recycling option.

8. INTERIM MEASURES CONSIDERATIONS

An interim solution includes the delivery of food scraps from the residential sector to one of the County's three municipal solid waste transfer stations (locations include White Plains, Yonkers and Mount Vernon). It is assumed that food scraps received from the residential sector have been collected at individual municipalities through either voluntary drop-off programs and/or curbside collection.

In order to implement this interim measure, the food scraps could be handled under three different scenarios. The first scenario includes the direct loading of food scraps into the compactor and then pushing them into a lined ejection trailer for transport. The second scenario involves tipping food scraps onto the tipping floor where they would be pushed against a push wall by a bucket loader and loaded into dump trailers which would be sealed to reduce leakage. The third scenario would require repositioning of the compactor to allow tipping directly into an open top trailer with a specially designed hopper to minimize spillage. Under this scenario the trailer would also be lined to reduce spillage. The transfer trailer would be stationed so that food scraps could be loaded once per week. Once loaded the transfer vehicle would transport the food scraps to a food scraps recycling facility. Currently, residential food scraps collected at each individual municipality are hauled to the Ulster County Resource Recovery Agency (UCRRA) facility for composting, and it is assumed that this potential interim measure managed by the County would also include transporting the food scraps to Ulster County or another suitable recycling location.

It should be noted that there are technical and regulatory challenges that would need to be addressed in order to make this potential interim measure feasible. Currently, the existing transfer stations are not designed to accept separate deliveries of the food scraps. As a result, the County would need to designate a specific day per week for food scraps loading and hauling. For the first and third transfer station interim scenarios, the quality control standards would necessitate the tipping of food scraps directly onto the tipping floor at a certain frequency to monitor for contamination. This is because tipping food waste directly onto the floor would exacerbate the leachate concerns, potentially putting the County at risk for non-compliance with their NYCDEC operations permit and other applicable regulations.

With respect to transfer station option two, the same leachate concerns would apply for each load tipped onto the floor. Woodard & Curran recommends that, for interim measure option three, a detailed engineering study be completed to thoroughly evaluate the feasibility of utilizing a specially designed trailer for direct loading, as well as to evaluate the need for additional infrastructure modifications, because the County's transfer stations are generally designed more for compactor loading of incoming MSW loads.

For each of the interim options presented herein, in addition to leachate management concerns on the tipping floor, it should be recognized that there could also be potential concerns with leachate migrating to the exterior of the building. If the County decided to proceed with any of the three interim measures presented herein, a comprehensive engineering report should be prepared to address the regulatory/permitting and technical needs, particularly in light of the current leachate management concerns at each of the transfer stations. From a permitting perspective, the existing solid waste management operating permits for the transfer facilities may need to be amended to include the change in operations to include food scraps loading and hauling. This possible amendment would need to be discussed with the NYSDEC.

From a scheduling perspective, although the completion of an engineering report would not impact the estimated time frame for permitting, design and construction (estimated at 6 months to 1 year), it should be assumed that on the front end, an engineering report could take approximately 6 months to complete, for a total estimated time of 12 to 18 months for the implementation of the interim solution.

In addition, it is understood that periodically during the course of the year, the Wheelabrator WTE facility is unable to accept MSW, or operates on a reduced capacity basis due to planned and unplanned outages, including equipment downtime. As an example, in 2019 alone there are 11 planned outages for maintenance purposes, and this does not include unplanned outages due to equipment downtime/repair needs etc. This would result in the need for additional MSW storage on a temporary basis at the transfer stations, which thereby impacts the ability to accept separate food scraps deliveries at the transfer stations during those time periods.

While potential interim, mid-term and long-term County wide solutions are presented in this Report, there may also be short term considerations that may apply more directly to individual municipalities. Depending on availability of open land, sensitive environmental receptors and overall public support, municipalities may consider individual composting sites for food scraps. The construction and operation of such a facility would need to be permitted and each municipality would need to address the up-front capital investment, and operations needs either through outsourcing or through municipal staff. Another potential local short-term solution for municipalities would include individual micro anaerobic digesters, which would also require permitting, up front capital expenditures, and staffing for operations. This Report is focused on County wide food scraps recycling solutions which would benefit both the residential and commercial sectors.

9. OVERALL PROGRAM IMPLEMENTATION SCHEDULE

It is expected that the County will utilize this Report to guide the additional future planning and engineering needed to implement a County-wide food waste recycling program and recycling facility(ies). Below is a summary of the estimated timeframes for implementation of the recommended short and mid to long-term solutions:

9.1 Interim Solution: Transfer Station Accommodations for Food Scraps

Engineering Report, Site Assessment and Selection	6 months
Permitting and Site Preparation	6-8 months
Equipment Procurement	5-6 months
Total Timeframe (Approx.):	**18 months**

9.2 Mid-Term Solution: Co-Digestion at Peekskill's WRRF

Request for Qualifications	2-3 months
Existing Facility Evaluation and Due Diligence	4-5 months
Design and Development of Plans/Specifications	6-8 months
Permitting	5-7 months
Bidding and Contract Procurement	3 months
Construction and Commissioning	10-12 months
Total Timeframe (Approx.):	**36 months**

9.3 Mid-Term Solution: Anaerobic Digester Co-location at Wheelabrator's WTE Facility

Feasibility Study and Due Diligence	3-4 months
Project Scoping	2-3 months
Request for Proposals	3 months
Proposal Evaluation and Contract Procurement	2 months
Permitting and Design Development	10-12 months
Construction and Commissioning	11-12 months
Total Timeframe (Approx.):	**36 months**

9.4 Long-Term Solution: Anerobic Digester at County's Water Tower Site

Feasibility Study and Due Diligence	4-6 months
Design and Development of Plans/Specifications	7-8 months
Permitting	6-12 months
Bidding and Contract Procurement	3 months
Construction and Commissioning	20-22 months
Total Timeframe (Approx.):	**48 months**

Note that some overlapping may occur between activities; Refer to Figure 17 – Overall Implementation Schedules for the anticipated implementation timeframes for these solutions. It should be noted that timeframes will ultimately depend on the proposed scope of work for the project and therefore an actual schedule should be developed once a project has been defined.

In parallel to any of these solutions, it is recommended that dialogue remains open with compost facility operators who have an interest in being part of the food waste processing and recycling solution in Westchester County.

As part of this Study, Woodard & Curran spoke with Atlas Organics who build and operate mass bed composting facilities and who have an interest in locating a facility in Westchester County. For the mass bed technology, the food waste, which is combined with yard waste (a 50%/50% mix) to incorporate a carbon source, is placed over a wide, broad area, or in a "bed", which can be indoors in open air or under cover. In order to make the operation financially feasible in Westchester County, Atlas is considering a minimum facility capacity of 150,000 ton/year (75,000 ton/year food waste, 75,000 ton/year yard waste), which would require between 20 to 30 open acres for the proposed facility at a cost estimated between $20M to $25M, plus the depackaging system at about $3M. Atlas estimates a total of 18 months would be required following property acquisition, to complete permitting, design and construction for a 150,000 ton/year facility (75,000 tons food waste, 75,000 tons yard waste).

In the case of Atlas, should they ultimately be successful with acquiring property (a minimum of 20 to 25 acres is needed) and negotiating a deal with City Carting to take the yard waste they currently haul away, the Atlas facility could conceivably be able to process an additional 75,000 ton/year of food waste (plus 75,000 ton/year of yard waste) through their composting operations. Also, in the long term, the County should continue to investigate the availability of other property for acquisition and development of a facility which could further support food waste recycling within the County.

In addition, along with the implementation program, it would be beneficial to initiate outreach efforts to communicate with the commercial and residential sectors as part of a community engagement program to ensure that they have the infrastructure in place to support food waste recycling and collection. The commercial sector would also be working on negotiations with haulers and considering benefits to doing this with other commercial establishments as opposed to individually.

The Food Donation and Food Scraps Recycling Act (effective January 2022) will require large food waste generators in the commercial sector (i.e. 2 tons/week or more) to separate edible and inedible food waste and to send their inedible food waste to a licensed recycling facility, provided there is a facility within a 25-mile radius. Certain solutions presented in this report may be operational soon after the January 2022 date.

10. PERMITTING AND REGULATORY CONSIDERATIONS

The purpose of this section is to provide an overview of typical site development and environmental permits required for the development of a food waste processing facility. While actual permitting requirements will ultimately depend on site disturbance, facility size and throughput, site location, spatial and environmental constraints, scope of operations, etc. some of the permits that may be required include:

1. *NYSDEC SPDES Stormwater Management and Permitting (SWPPP, NOI, NOT)* – Typically required for greater than one acre of land disturbance, or 5,000 square feet of land disturbance in the NYCDEP East of Hudson Watershed.
2. *Floodplain/Floodway Management per FEMA Regulations* – Typically required for proposed work where there is filling within the 100-year floodplain or work within the floodway.
3. *Freshwater Wetlands* – Typically required for proposed work with disturbance or construction related activities within the freshwater wetland or within the 100-foot wetland adjacent area/buffer.
4. *Tidal Wetlands* – Typically required for proposed work with disturbance or construction related activities within the tidal wetland and/or within the 300-foot wetland adjacent area/buffer below elevation 10.0'.
5. *NYSDEC Section 401 Water Quality Certification (WQC)* – Typically required for projects with Federal permits to verify state water quality standards are not violated.
6. *NYSDEC Rare Plants and Animals & Significant Natural Communities Permits* – Typically required for projects with disturbance or construction related activities within an area determined to have rare plants and animals or an area designated as a significant natural community as determined by viewing the NYSDEC Environmental Resource Mapper.
7. *NYSDEC Protection of Waters Permit* – Typically required for projects with disturbance or construction related activities within a classified waterbody (i.e. disturbance to the bed or bank), construction or reconstruction of a dam, construction or reconstruction of docks or moorings, or excavation/filling within navigable waters or their adjacent wetland areas. Classified waterbodies and wetlands are identified by viewing the NYSDEC Environmental Resource Mapper. Typically required for class A, B, C(T) classified streams, but this should be confirmed on a per project basis.
8. *NYSDEC Solid Waste (including Air Quality)* - Typically required for projects associated with Material Recovery Facilities and compliance with Part 361 for Organic Recycling Facilities and Regulations, including air emissions.
9. *NYSOGS Bureau of Land Management (State Owned Land Under Waters*) – Typically required for projects with disturbance or construction related activities such as structures, including fill, located in, on, or above state-owned lands under water, which are regulated under the Public Lands Law.
10. *NYSDOS Coastal Consistency* – Typically required for projects located within the Landward Coastal Boundary that also require a Federal (i.e. USACE) permit. The proposed project scope must be consistent with and address all coastal policy criteria in the New York State Coastal Management Program or Local Waterfront Revitalization Program (LWRP) if one exists.
11. *NYS Office of Parks, Recreation, and Historic Preservation (SHPO*) – Typically required for projects located within an "archeologically sensitive" area (or if a registered historic landmark) as determined by the NYSHPO GIS mapping tool and requiring a State (i.e. SPDES, Protection of Waters, etc.) permit or if the project is funded by the State in any way.

12. *NYS Department of Health (Septic, Water, PBS, Air, etc.)* - Typically required for installation of a new backflow preventer, construction of a new septic system, well development or other public water supply improvements, well decommissioning, petroleum bulk storage, etc.
13. *New York State Department of Transportation* – Typically for projects where work is proposed within the right-of-way (ROW) of State roads/property.
14. *New York City Department of Environmental Protection (NYCDEP East of Hudson Watershed)*
15. *State Environmental Quality Review (SEQR)* – Typically required reviewed for all site development projects to identify, assess, and mitigate significant environmental impacts of the proposed activity.
16. *United States Army Corps of Engineers (USACE Individual, Regional, Nationwide Permits)* – Required for projects with construction in or adjacent to navigable waters of the United States.
17. *Westchester County (Various Departments and Permits for Coordination)*
18. *Local Permitting/Approvals (Site Plan, Zoning, Building, etc.)* (May not be applicable considering County is Owner and exempt from local requirements)

To assist in determining the required permits associated with a project, it is often advisable or in some instances required to complete and submit jurisdictional request determinations to each involved agency to get a definitive answer whether any permits are required dependent upon the scope of the proposed project. This requires applicants to plan accordingly as responses to jurisdictional requests can take 30-60 days or more depending on when the request is deemed complete and when the request gets formally entered into the respective agency's system.

Our expectation is that any Westchester County related permits and approvals that are typical of similar facilities will be handled internally by various County departments.

Our expectation related to local permits and approvals is that the County is not subject to the local permitting boards and associated requirements, however it is often advisable that the County maintain some level of transparency for development plans as a courtesy to the local jurisdiction.

11. FUNDING OPPORTUNITIES

Funding options will depend on the final project scope and site selection, but the following Federal and State programs are most likely to support the project.

FEDERAL PROGRAMS

- US Department of Commerce Economic Development Administration (EDA) Public Works & Economic Adjustment Assistance Program

Under the Public Works and Economic Adjustment Assistance Program, the Economic Development Administration (EDA) provides strategic investments on a competitive merit basis to support economic development, foster job creation, and attract private investment in economically distressed areas. Grants and cooperative agreements are intended to leverage existing regional assets and support construction, non-construction, planning, technical assistance, and revolving loan fund projects. The program particularly targets economic development strategies that advance new ideas and creative approaches to promote economic prosperity in distressed communities.

EDA will fund projects that meet at least one of its investment priorities. The construction of a Food Waste Facility in the City of Yonkers would meet several, including the potential to address national strategic priorities (climate and sustainability planning and implementation), environmentally sustainable development, and investment in an underserved community. The same priorities would be met if a north County facility were to be sited in an underserved community. The 2013-17 Hudson Valley Regional Council Comprehensive Economic Development Strategy (CEDS) identifies food recovery and composting as one of four important regional issues of focus. If the County facility(ies) also will serve one or more neighboring counties, the project would meet Goal III of the CEDS, to "Promote inter-county cooperation and efficiencies in the key environmental areas of solid waste/materials management, green infrastructure and water quality."[23]

Additionally, projects must meet one or more of the following economic distress criteria: (i) an unemployment rate that is, for the most recent 24-month period for which data are available, at least one percentage point greater than the national average unemployment rate; (ii) per capita income that is, for the most recent period for which data are available, 80 percent or less of the national average per capita income; or (iii) a "Special Need" as determined by EDA, including, but not limited to loss of a major employer essential to the Regional economy, substantial out-migration or population loss, underemployment, and military base closures or realignments. Project eligibility will depend on the location and characteristics of the facility sites that are selected.

In general, award amounts will not exceed 50% of the total project cost but additional amounts may be awarded. The average size of a Public Works investment is $1.4 million with most ranging between $600,000 and $3,000,000.

In FY 2018, $117.5 million was appropriated for the Public Works program, $37 million for the EAA Program, and an additional $30 million in EAA funds to support communities and regions negatively impacted by changes in the coal economy (i.e., Assistance to Coal Communities). The average size of a Public Works investment has been $1.4 million with a range of $600,000-$3,000,000. The average size of the EEA investment has been approximately $650,000 with a range of $150,000-$1,000,000. Public Works and EEA-funded projects typically require a 50% match that may be modified to 20% based on relative regional need.

[23] Hudson Valley Regional Council, *2013-2017 Hudson Valley Economic Development District Comprehensive Economic Development Strategy*, pp. 159-160.

EDA uses a 2-phase review process for applications and there are no submission deadlines. Proposals and applications are accepted ongoing until the publication of a new EDAP Notice of Funding is issued. Proposals are reviewed by EDA within 30 days of receipt and full applications within 60 days of receipt. The most recent EDAP NOFA took effect July 2, 2018.

NEW YORK STATE PROGRAMS

- New York State DEC Municipal Waste Reduction and Recycling Program

The Municipal Waste Reduction and Recycling Program (MWRR) is funded through the New York State Environmental Protection Fund and administered by the DEC Division of Materials Management. The program is designed to assist government entities in expanding, improving, and promoting their local waste reduction and recycling programs. Eligible entities include counties, cities, towns or villages; local public authorities; local public benefit corporations; school, supervisory and improvement districts; Native American tribes or nations residing in NYS; or any combination of the above. By law, private companies, not-for-profit organizations, and State agencies are not eligible to participate in the program.

Eligible costs include

- Capital Investment in Facilities and Equipment
- Recycling Education/Promotion/Outreach and Coordination, and
- Waste Reduction Capital or Education

Examples include dedicated facilities planned, designed, and constructed to ensure environmental protection and to maximize recyclables recovery; structures, machinery, or devices required to separate, process, modify, convert, treat, or prepare recyclables, collection vehicles specifically dedicated to hold/transport source separated recyclables; add-ons/trailers to modify collection vehicles for materials sorting/separation; containers or bins for collection in public spaces; composting facilities and equipment; direct costs for recycling public education/promotion/outreach.

Eligible projects are expected to enhance municipal capacity to collect, aggregate, sort and process recyclable materials. Recycling equipment includes structures, machinery, or devices that provide for environmentally sound recovery of recyclables including source separation equipment and recyclables recovery equipment. Recycling education and coordination is expected to promote and encourage participation in local recycling programs. Waste reduction capital or education can include the capital, planning, and promotional costs of waste reduction projects undertaken to reduce the volume or toxicity of material entering the Municipal Solid Waste stream by reducing the volume or toxicity of material at the point of generation.

The total program funding in 2018 was $9 million, the amount dependent on annual appropriation by the NYS Legislature. Grants can be used to fund up to 50% of eligible project costs to a maximum of $2M per project. If Federal or other assistance is received for the project, reimbursement will be limited to 50% of the net eligible costs after deduction of that assistance. Applicants must be registered with, and apply through Grants Gateway and must provide the following as appropriate for the project:

- Program Specific Q&A
- Work Plan Overview & Objectives
- Detailed Budget Sheet and Expenditure Budget
- Municipal Recyclables Summary Sheet
- Applicant's Local Recycling Law (per GML 120-aa)

- Recycling Coordinator Job Description (Coordination/Education Projects)
- Vehicle Information Forms
- Title Certificate for Property (Construction Projects)
- Building Floor Plan Sketch (Construction Projects)
- Payment Background Documents (if purchases completed)
- Project Report for Coordination/Education Projects

There is no specific application deadline. Proposals are accepted on an ongoing, first come-first serve basis. Each proposed project will be evaluated and if conceptually eligible will be placed on the MWRR waiting list in order of the date the eligible proposal was created in Grants Gateway.

- Empire State Development Grant Funds

In 2019, the Regional Council Capital Fund, though ESD, is making available $150 million in capital grants to the State's Regional Economic Development Councils for capital-based economic development projects that create or retain jobs; prevent, reduce or eliminate unemployment and underemployment; and/or increase business or economic activity in a community or region. The Mid-Hudson Regional Economic Development Council will award funds to projects it identifies as significant, regionally supported, and capable of stimulating economic investment. Special consideration shall be given to projects supporting the Downtown Revitalization Initiative and Strategic Community Investment, Improving Access to Child Care, and Environmental Justice. Counties are included in the list of eligible applicants.

ESD assistance is provided for business investment, infrastructure investment, and/or economic growth investment. Funds may be used for acquiring land, buildings, machinery and/or equipment; demolition and environmental remediation; new construction; soft costs up to 25% of the total project cost; and planning and feasibility studies related to a specific capital project or site. The amount of an award from ESD is based on a number of factors including, but not limited to, the project's alignment with the state and regional priorities, the potential for direct and indirect job creation, direct and indirect fiscal benefit to the state and local governments, overall economic activity, community development and private investment. Generally, applicants should not apply for, nor will be considered for, more than 20% of the financing for any project based on the eligible total project cost. Typically, awards will be less than 20% of the eligible total project cost and the likelihood of winning an award improves as the percentage of ESD assistance is reduced and private investment or other sources are better leveraged. Exceptions to this limit may be made at the sole discretion of ESD in cases where it is found that a project or projects will have an unusual or extraordinary regional or statewide impact. ESD requires that the Applicant contribute a minimum of 10% of the total project cost in the form of equity contributed after the Applicant's acceptance of ESD's incentive proposal. In addition, a $250 Application Fee, payable when funding is documented in an Incentive Proposal, and a 1% non-reimbursable commitment fee based on the grant amount awarded will be assessed to all awardees. The commitment fee will be due when the Applicant executes documents required for processing the award, after approval by the ESD Directors. The Applicant will be obligated to pay for out-of-pocket expenses incurred by ESD in connection with the project, including, but not limited to, expenses related to attorney fees, appraisals, surveys, title insurance, credit searches, filing fees, public hearing expenses and other requirements deemed appropriate by ESD.

Funding will be awarded by the New York State Urban Development Corporation (d/b/a Empire State Development) at its discretion. Applicants must complete and submit a Consolidated Funding Application (CFA) for review by ESD and the Regional Council for the region in which the proposed project is located. CFA applications are due by 4:00 p.m. on July 26, 2019.

- NYS DEC Climate Smart Communities Grant Program

The Climate Smart Communities Grant Program funds inventory, assessment, planning, and implementation projects that advance the work of municipalities in addressing climate change. The program also supports municipal mitigation implementation projects that reduce greenhouse gas (GHG) emissions from the non-power sector and 2019 program priorities include specific mitigation activities related to transportation and reduction of food waste. Counties are eligible to apply, as are cities, towns, villages and boroughs of the State of New York. The program encourages partnership projects with a single lead applicant. Implementation and planning projects are both eligible activities. Implementation projects must advance specific climate adaptation and greenhouse gas mitigation activities, including, specifically, the implementation of projects to divert food waste from landfills where it will produce methane.

The total available 2019 funding for Implementation Projects that mitigate GHG is $11,038,554. The minimum grant award is $10,000 and the maximum $2 million. Design and engineering expenses are limited to 15% of the grant request. In addition, no more than 50% of the total available funds for implementation projects will be awarded to municipalities with populations greater than 100,000 or to any single municipality.

Application is made through the Consolidated Funding Application (CFA) program which is open now; applications are due by 4:00 p.m. on July 26, 2019. Awards generally are announced in December.

- NYS Department of State Local Government Efficiency Program (LGE)

The Department of State administers the Local Government Efficiency Program the provides funding to local governments to reduce the cost of operations and service delivery, to limit growth in property taxes. Projects can include local government reorganization, shared services, city or county charter revisions that include functional consolidation, and establishment of regional service delivery. The Westchester County Municipal Waste Facility would qualify as a regional service delivery.

Local governments may apply for planning and implementation projects. The maximum funding for planning is $12,500 for each local government involved in the project, not to exceed $100,000. The maximum funding for implementation is $200,000 for each local government involved in the project, not to exceed $1,000,000.

Applicants are required to provide matching funds for all projects. Planning projects require a local cost share of at least 50% of the total project cost. Implementation projects require a minimum local cost share of at least 10% of the total project cost. (For projects that implement a planning grant previously funded under the LGE program, the grant award for implementation will be increased by the amount of the local matching funds provided for the planning grant).

All grants are reimbursement grants. To receive full funding, awardees must demonstrate that the project has received all appropriate public consideration and referenda where required.

The Department of State requires that all successful applicants enter into a contract with the State of New York. For the 2019 CFA, the contract will be a fixed term agreement and will be dated January 1, 2020 – December 31, 2024. The Department of State may cancel an award if the state contract is not returned in a timely manner. If an applicant is awarded a grant, the contract must be returned to the Department of State within ninety (90) days from its receipt to ensure that funds go to applicants that are ready to move forward. All projects must be managed in accordance with the terms and conditions of the state contract and follow state and local procurement policies.

An application is eligible to receive a total project score of 100: 80 percent derives from program review criteria and 20 percent from the Mid-Hudson Regional Economic Development Council (REDC) for concurrency of the project with the regional priorities.

Application is made through the Consolidated Funding Application (CFA) program which is open now; applications are due by 4:00 p.m. on July 26, 2019. Awards generally are announced in December.

ADDITIONAL FUNDING OPTIONS

Other funding opportunities may apply to the project depending on the final scope, cost, and facility location(s). In addition, elements of the project (e.g., water/wastewater management) may be eligible for grant assistances. Funding options should be re-evaluated when additional project details and scope becomes available.

12. COMMUNITY ENGAGEMENT

12.1 Stake Holders Session #1

On April 29, 2019, WCDEF hosted Stakeholders Session #1 at the County Building in White Plains, New York, with a panel of stakeholders selected by the County. The stakeholder's group included members of the community actively involved in food waste recycling initiatives, City officials with experience in waste management at the local level, and representatives from various organizations related to the food manufacturing, food donation and food waste recycling industries.

The purpose of Stakeholders Session #1 was to review the overall scope of the Study and discuss the various food waste management options, and challenges concerning the collection, handling and disposal of food waste.

Below is a summary of the discussions and stakeholders' comments and questions during Stakeholders Session #1:

- Running a successful operation (food waste management) in Westchester is a challenge for the municipalities, and it is better if private enterprises take over the role of food waste recycling but incentives should be offered. Industry wants several localized facilities. A good example of a successful local operation would be Stamford Materials Management in Cortlandt Manor, NY. This facility currently holds local and NYSDEC approvals to operate as an open-air composting facility. There is acknowledgement on the permitting and operational limitations that come with this approach. Another example of a successful local food waste recycling operation would be St. John's University, where students compost all food waste on site.

- Food rescue in accordance to EPA's Food Recovery Hierarchy should be followed. Also, it is very important to investigate food waste reduction at the source (i.e. before it becomes waste) so different techniques can be implemented on both the commercial and residential sectors. – *Refer to Section 3*

- A decentralized composting facility that can process food waste and yard waste appears to be the most attractive approach. The quality of the yard waste was mentioned as a concern along with the use of the composted materials. An idea was to require use of local compost from landscapers or for county soil restoration projects. – *Refer to Section 6*

- Scarsdale's food waste recycling program has 1,200 households enrolled now. The program has been successful in part due to curbside collection at no additional cost to the residents. Suburban carting performs the curbside pickup and carting to Ulster County where it the food waste is composted. Scarsdale's schools are running their own program and they are looking at using compostable and/or re-usable materials. Suburban carting also does their pickup.

- There is ample room for improvement towards minimization of food waste and recycling of food waste. As an example, DeDicco's donates food to Westchester Harvest on a weekly basis, but food scraps currently go out in the regular garbage – *Refer to Section 3.1*

- Perhaps initial legislation should be passed on simpler things, such as the elimination of plastics and Styrofoam and the requirement of compostable materials. County needs to make sure that whatever technology they select can deal with compostable materials. – *Refer to Section 4*

- One big challenge is that compostable materials take much longer to compost. There is a need to use an industrial grinder for these type materials, and they compost better in vessel. – *Refer to Section 4*

- There are many road barriers and challenges for the recycling food waste, including cost, space, technology limitations and quality/use of the end product. – *Refer to Section 4*

- An educational program is critical because people will actually mix food waste/scraps with regular waste. It is important to engage with the public and educate. – *Refer to Section 3*

- One big hurdle is additional cost for curb side food waste pick up. We need incentives and enforcement. There is advantage if municipality picks up the garbage for no extra fee, included in taxes. – *Refer to Section 5*

- Blue Hill Farm removes about 2,000 yards per year. 50-150 ton/year is the target. At $27 per ton of waste. It was questioned how the operation can be viable for a business.

- Quantum Biopower in Southington, Connecticut, has had past challenges with process compostable bags - *Refer to Section 4*

- The following questions were raised during the meeting:

  - Is there an initiative to address food waste recycling by legislation besides the Act coming soon? Is the County and Woodard & Curran going to go to the Board of Legislators to encourage them to pass a law to centralize the process? *Woodard & Curran responded that they are prepared to support those discussions, if needed.*

  - Are there many sites being evaluated as options? Woodard & Curran responded that the County property known as the "Water Tower" is not the only site being analyzed as part of the Study. - *Refer to Section 6*

  - Is the County looking at various technologies for food waste processing? – *Refer to Section 4*

  - What is in the scope of work to be able to reduce at the source or donated? – *Refer to Section 3*

  - Is the Study looking into management of byproducts? - *Woodard & Curran clarified that management of by-products is not currently analyzed in depth within the current scope of work.*

  - What kind of incentive is the County offering municipalities? – *Refer to Section 8*

12.2 Public Forum Summary

On May 9, 2019, WCDEF hosted a public forum to open community discussions on the proposed food waste recycling program. In attendance were WCDEF Commissioner Vincent Kopicki, WCDEF Assistant Commissioner Mario Parissi, WCDEF Employees Tom Higgins and Sean O'Rourke, County Executive's Office Representative Aviva Meyers, County Sustainability Director Peter McCartt, County Legislators MaryJane Shimsky, Chris Crane and Catherine Parker, and Woodard & Curran representatives Anthony Catalano and Alvaro Alfonzo-Larrain. During the hearing, Woodard & Curran summarized the food waste study scope and attendees were invited to offer input related to the food waste study.

Highlights of comments from the public are summarized as follows:

Speaker 1:

A representative of the Federated Conservationists of Westchester County requested that the food waste study move to minimize food waste and seek to reuse food waste to the greatest extent possible, while minimizing carbon emissions associated with food waste collection and disposal. The speaker requested that food donation be incorporated into the study to the greatest extent possible and that food scraps be processed locally at strategic sites. The speaker asked that the County support public education about food waste recycling by establishing food scrap drop-off sites, that the County take steps to encourage backyard and commercial on-site composting of food waste, and that the County incentivize development of on-site food waste processing facilities at large food waste generation sites. The speaker offered the assistance of the Federated Conservationists of Westchester County in the development of the food waste recycling program.

Speaker 2:

A representative of Sustainable Materials Management, Inc. voiced support for a food waste recycling program. The speaker advocated for composting as a means to mitigate climate change impacts. The speaker indicated that Sustainable Materials Management, Inc. has done research showing that aerobic composting facilities utilizing forced aerations are an optimal food waste recycling solution. The speaker requested that the County adjust its existing inter-municipal agreement to dispose of municipal solid waste to provide a financial incentive to divert food waste to a food waste recycling facility. The speaker indicated that food waste recycling and composting facilities typically have lower tipping fees than incinerators. The speaker requested that the County mandate point-of-use food waste separation and recycling for all waste generators, regardless of food waste generation quantity.

Speaker 3:

A representative of the Mount Kisco Conservation Council indicated that Mount Kisco intends to have a food scrap recycling program in place by the end of 2019. Mount Kisco currently ships its food waste a long distance. The speaker asked that the County's food waste program include a local food waste processing facility. The speaker asked Woodard & Curran to perform more outreach with local municipalities for a smooth transition to food waste recycling.

Speaker 4:

A representative of the Rye Sustainability Committee indicated that the City of Rye started a food waste recycling pilot program. The speaker indicated that the pilot program includes 300 people and includes curbside pickup and drop-off components. The speaker voiced support for the County's efforts to expand food waste recycling.

Speaker 5:

A representative of the New York chapter of the Climate Reality Project indicated that a food scrap drop-off site is in place in the Town of Bedford.

Speaker 6:

A representative of the Unitarian Universalist Congregation of White Plains and Scarsdale resident noted that Scarsdale currently offers curbside food scrap pickup and that curbside pickup has greatly reduced the amount of trash they send to the County's incinerators. The speaker voiced support for the County's efforts to expand food waste recycling locally to minimize carbon emissions associated with hauling and incineration.

Speaker 7:

A representative of the Village of Irvington's Green Policy Task Force and the Hudson River Clearwater Festival reiterated the importance of food waste recycling. The speaker indicated that the New York State Association for Reduction, Reuse and Recycling and the Cornell Waste Management Institute are valuable sources of information relating to food waste diversion.

Speaker 8:

A representative of We Future Cycle discussed their experience implementing recycling programs in Westchester schools. The speaker indicated that cost has been a major barrier to more schools adopting recycling because wasting in trash is typically cheaper to dispose of and is collected more frequently. The speaker requested that the County's food waste program focus on providing greater incentives to divert waste from the trash stream. The speaker indicated that single-serve packaging is also an issue in the food waste stream. The speaker suggested that comprehensive waste diversion education is best started in schools.

Speaker 9:

A representative of Pleasantville Recycles endorsed the County's food waste study. The speaker indicated that Pleasantville Recycles has seen great enthusiasm for the Study. The speaker encouraged the County to build its own food waste processing facility.

Speaker 10:

A representative of the Town of Greenburgh Conservation Advisory Council. The speaker indicated that Greenburgh has looked into curbside pickup of food waste and the Conservation Advisory Council was tasked with researching it. The speaker requested that the County's food waste study provide an energy conservation analysis to determine whether the emissions associated hauling and processing outweighs the emissions saved via food waste diversion.

Speaker 11:

County Legislator MaryJane Shimsky indicated her approval of the food waste study. The speaker asked that the Study consider all possible alternatives and the carbon footprint issues. The speaker requested that the final food waste diversion plan minimize hauling distances. The speaker requested that land use considerations be tailored to the communities where food waste processing facilities are sited. The speaker indicated that curbside pickup would likely be necessary to expand food waste collection, especially for those residents who do not own a car. The speaker voiced support for anaerobic digestion in areas where land is limited and collection and distribution of gas from the anaerobic digestion process.

Speaker 12:

A representative of the City of Rye Conservation Commission/Advisory Council indicated that their organization supports the food waste study. The speaker requested that the food waste study address food insecurity as part of its scope by incorporating food donation. The speaker spoke about their experience with food scrap diversion in Philadelphia. The speaker indicated that Philadelphia used to sell food scraps it collected at a profit, and that this method could be viable in the County.

12.3 Stake Holders Session #2

On July 29, 2019, WCDEF hosted Stakeholders Session #2 at the County Building in White Plains, New York, with the selected stakeholder's group (same group in Stakeholder Session #1). The purpose of Stakeholders Session #2 was to discuss initial findings and general progress of the Study, and to gather input from the stakeholders on additional information that should be included in the Report. The format of the session was a brief presentation on project status by Woodard & Curran followed by an open discussion with Woodard & Curran, Westchester County, and the stakeholder's group.

The following are highlights of comments and questions provided by the stakeholders during Stakeholders Session #2:

- A localized approach to food waste recycling would be the preference. Challenges include availability of sites and local permitting requirements.
- Westchester County's proposed contribution to local municipalities consists of providing an outlet for large quantities of food waste to be processed and recycled within the County, a much better solution than current practices (i.e. food waste incineration and hauling to Ulster County for composting). Both short and mid to long-term solutions provide this benefit to local municipalities, resulting in lesser hauling distances and processing costs. - *Refer to Section 6*

- The goal of recycling food scraps should be to capture the resources (energy and nutrients) in the food scraps. In the co-digestion proposed scenario, there needs to be more clarity with flaring the gas and landfilling the digestate. – *Refer to Section 6.2.1*
- Consideration should be given to smaller-scale and County-run composting and digester operations. A compost facility could offer benefits to the County yard waste program since a compost facility could accept yard waste which is currently trucked upstate area and environmental constraints need to be considered. - *Refer to Section 6*
- The following questions were raised for the co-digestion alternative at Peekskill's WRRF: (*Refer to Section 6.2.1 for answers within the scope of this Study)*
  - What percent of the WRRF is currently being powered by digester gas? And flared?
  - How much energy will 10,000 tons of food waste generate in electricity, natural gas, or combined?
  - How much energy will the upgraded WRRF utilize? If there is excess energy, what will the gas/electricity be used for?
  - What is the breakdown of the cost estimate and timelines for the proposed solutions to understand what aspects are included in the estimate and assumptions?
  - What is the plan for the digestate? If not being used for beneficial use immediately, what is the timeline and plan for putting to a beneficial use?
- The following questions were raised for the anaerobic digester at Wheelabrator WTE Plant (*Refer to Section 6.2.2 for answers within the scope of this Study)*
  - How much energy will 10,000 tons of food waste generate in electricity, natural gas, or combined?
  - How much energy will the anaerobic facility utilize? If there is excess energy, what will the gas/electricity be used for?
  - What is the breakdown of the cost estimate and 24-month timeline to understand what aspects of the project are included in the estimate?
  - What is the plan for the digestate? If not being used for beneficial use immediately, what is the timeline and plan for putting to a beneficial use?
- The following general questions were raised around composting in the County *(outside of the scope of this Study):*
  - What is the minimum area the County would need to run a composting facility? What is the expected lead time, upfront and operating cost of such facility?
  - How much yard waste is currently being collected and shipped out of the County as part for the County yard waste program?
  - What is the location of current yard waste composting facilities?
  - Cost per ton of yard waste disposal?
  - Are there any suitable locations for a compost facility in a County park? What are the restrictions around composting in a County park?
  - Which municipalities have a yard waste recycling facility?
  - What is the cost for County to provide free/low-cost compost as a service to Westchester residents?

- Implementation timeframes in the Report should include any pre-requisites approval or studies that may impact overall project schedule. – *Refer to Section 9*
- The Study should include possible near term-solutions (within 6-12 months) – *Refer to Section 8*
- Study should provide a greenhouse gas (GHG) emission comparison including all major aspects of each processing methods - *Refer to Section 7 for partial scope*
- The Report should include all input parameters used in the GHG calculations – *Refer to Appendix C.*

TABLES

FIGURES

APPENDIX A

Westchester Commercial Food Waste Data

(electronic format / USB Drive)

AAPPENDIX B

Greenhouse Gas Emissions Model

APPENDIX C

Greenhouse Gas Emissions Calculations and Model Summary Report

(Calculations in electronic format / USB Drive)

[redacted]

Woodard & Curran Engineering P.A. P.C.
January 2020