Lanchester Landfill Service Area

ZERO WASTE PLAN

LANCHESTER LANDFILL SERVICE AREA

October 2021

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Introduction

The Lanchester Landfill Service Area includes 49 municipalities in northern Chester County (Listed in Appendix A) and Caernarvon Township, Lancaster County. The area consists of one city, suburban, and rural areas with a population of about 450,000.

Chester County Solid Waste Authority (CCSWA) adopted its Mission Statement in 2015, which included the long-term goal of zero waste. CCSWA started working with GBB Solid Waste Management Consultants (GBB) in 2017 to request letters of interest on Alternative Disposal Technologies. CCSWA's Lanchester Landfill currently has over 15 years of permitted capacity, but as part of its Zero Waste planning is exploring other disposal, reuse and recycling technologies.

CCSWA is a Solid Waste Environmental Excellence Performance (SWEEP) Pilot Participant. CCSWA is planning to achieve SWEEP+ status over the next year.

CCSWA's Environmental Management System is committed to operating with environmental stewardship as a core value. CCSWA's Environmental Policy Statement is included in Appendix B. Lanchester Zero Waste Plan (LZWP) does not apply to the entire Chester County or the Southeastern Chester County Refuse Authority (SECRA) Landfill Service Area.

Lanchester Landfill's waste stream has been analyzed for its composition twice in the past, and an additional waste sort was completed in 2020. These reports are available in Appendix C.

Chester County Solid Waste Authority

Mission Statement:

To manage all discarded materials in the Lanchester Service Area with minimum environmental impact and with an overall long-term goal of zero waste.

Goals:

1. Encourage curbside pickup of municipal solid waste, recyclables and organics utilizing a system of a single hauler contract or collection by municipal personnel and equipment. municipally managed single hauler system.
2. Eliminate the burning of municipal solid waste, recyclables and organics.
3. Promote source reduction by consumers, businesses and institutions.
4. Reuse materials by promoting organizations that provide for either/both the collection of materials or the redistribution of materials
5. Recover materials to be used as feedstock for their industry of origin or secondarily other industries in a sustainable manner.
6. Recycle materials that have market value or that their recycling through a life cycle analysis uses less energy than waste-to-energy.
7. Promote the recovery of energy and utility of organics through composting and digestion.
8. Promote the use of proven, innovative recovery systems.
9. Promote the use of residuals on their own or combined with other materials as new products.
10. Utilize waste-to-energy and landfilling at state-of-the-art facilities when all other methods of managing materials listed above cannot be utilized.

Plan Development

1) Encourage curbside pickup of municipal solid waste, recyclables and organics utilizing a municipally managed single hauler system or municipal personnel:
- **a)** The Recycling Resource Manager will target municipalities that don't have mandatory waste, recycling and organics collection to provide them with sample ordinances for mandatory curbside collection.
- **b)** The Recycling Resource Manager and Executive Director will target municipalities without a single hauler system concerning the environmental and financial advantages of such a system.

2) Eliminate the burning of municipal solid waste, recyclables and organics.
- **a)** With the amendment of the Municipal Waste Planning, Recycling and Waste Reduction Act (Act 101) of December 9, 2002, Pennsylvania Department of Environmental Protection (PADEP) in Section 905 (c) will limit grants to any municipality that allows the burning of yard waste. The Recycling Resource Manager will remind municipalities that if they don't have a burning ban, there will likely be financial, health and environmental effects.
- **b)** The Recycling Resource Manager will develop information to fire departments and Code Enforcement Officers on their vital role of using municipal ordinances to protect infrastructure, public health and the environment.

3) Promote source reduction by consumers, businesses and institutions:
- **a)** Consumers – Develop advertisements, press releases, and public service announcements for municipal websites and newsletters; offer presentations. This would include regular household trash and household hazardous waste.
- **b)** Businesses —Coordinate business stakeholders to share resources and information on successful source reduction programs.
- **c)** Institutions – (schools, medical facilities, nursing homes and others) Encourage school districts to include source reduction opportunities in solid waste bid proposals. Develop information to assist institutions in reducing waste.
- **d)** Municipalities – Provide educational resources to municipal Recycling Coordinators to help them promote source reduction in their communities. Encourage local governments to adopt resolutions in support of their local commitment to achieving zero waste.
- **e)** Zero Waste Plan Grant Program – The ~~the~~ CCSWA Board of Directors authorized individual grants up to $5,000 and a total of $50,000 for the first round starting in 2021. Details of the Zero Waste Grant program can be found in Appendix D.

4) Reuse materials by promoting organizations that provide for either/both the collection of materials or the redistribution of materials
- **a)** Promote the repair of reusable goods – highlight for-profit and not for profit business that repair reusable items.
- **b)** Promote institutions like Goodwill and Habitat for Humanity ReStores.
- **c)** Provide a map on the CCSWA website of locations that accept items for reuse or repair

5) Recover materials that are used as feedstock for their industry of origin or secondarily other sectors in a sustainable manner:

a) Paper and other wood fiber-based materials should have their fibers reused to make paper products that use recycled materials if determined to be the best environmental option.
b) One secondary market for mixed paper is shredding to be used as insulation or animal bedding.

6) Recycle mandated materials, non-mandated materials that have market value, or that their recycling through a life cycle analysis uses less energy than waste-to-energy:
a) Continue to educate public and encourage enforcement as needed for mandatory materials.
b) Provide opportunities for public to recycle non-mandated materials, through drop off locations or promoting businesses that accept these materials.
c) Utilize valid metrics of life cycle analysis, such as United States Environmental Protection Agency has a Recycled Content (ReCon) Tool for this evaluation. ReCon can be found at - https://www.epa.gov/warm/recycled-content-recon-tool#online
i) Evaluation Examples:
(1) Example #1 – one ton of newspapers mixed with waste would produce about 500 kWh of energy in a waste to energy plant. One ton of newspapers being recycled saves 36.45 MMBtu, according to ReCon. This is equivalent to 10,682 kWh, so recycling saves about 10,182 kWh of energy by recycling the one ton of newspaper.
(2) Example #2 – one ton of HDPE contains 10,116 kWh[1] of energy. One ton of HDPE being recycled saves 61.11 MMBtu, according to ReCon. Recycling HDPE is equivalent to 17,910 kWh, so recycling saves about 7,794 kWh of energy by recycling one ton.
d) The market value of a recycled material - is the price an end market will pay net of transportation minus the processing cost.

7) Promote the recovery of energy and utility of organics through composting and digestion.
a) Continue to promote municipal yard waste composting operations. Being close to the source of yard waste reduces the transportation cost and environmental impact.
b) Continue to operate CCSWA's yard waste composting operation as a regional solution for private companies and municipalities.
c) CCSWA is a supporter of organics digestion on its property or at a third party's facility.

8) Promote the use of proven, innovative recovery systems.
a) In August 2018, GBB on CCSWA's behalf sent out Request for Information (RFI) to over 100 companies (Appendix D). We requested information on conversion technologies that are either:
i) **Proven:** Technologies for which there is a reference facility with a processing capacity at least 50% of that proposed for the CCSWA application and with at least three years of history processing MSW in the operating mode envisioned for the CCSWA application. The reference facility should produce at least 75% (on a revenue basis) of the products envisaged in the CCSWA application.
ii) **Demonstrated:** Technologies for which there is a reference facility with a processing capacity at least 10% of that proposed for the CCSWA application and with at least 1,000 hours of history processing MSW in the operating mode envisioned for the CCSWA application. The reference facility should produce at least 50% (on a revenue basis) of the products envisaged in the CCSWA application.
b) During 2022 CCSWA plans to visit at least two facilities that responded to the RFI.

[1] Determining Accurate Heating Values of Non-Recycled Plastics, Earth Engineering Center City College of New York, March 23, 2016

9) Promote the use of residuals on their own or combined with other materials as new products.

- **a)** CCSWA has utilized residual waste as alternate daily cover (ADC) at its Lanchester landfill. The use of ADCs reduces the use of a precious natural resource – soil.
- **b)** The Lanchester Landfill was one of the first landfills to utilize residual wastes in intermediate (Barrier®) and final (composted biosolids) final covers.

10) Utilize waste-to-energy and landfilling at state-of-the-art facilities when all other methods of managing materials listed above cannot be utilized.

- **a)** Lanchester Landfill has collected landfill gas since 2003 for beneficial use. With its landfill gas partner, EDL generates 3 MW of electricity enters the local grid. Also, over half of the landfill gas generated is distributed by a 13-mile pipeline to seven local companies so they can use the landfill gas to generate electricity, heat their buildings and use in their boilers.
- **b)** CCSWA has developed a "swap agreement" with Covanta Plymouth Meeting, where Chester County waste generators can send their waste to Covanta's facility. In return Covanta, in the same year, conveys the same tonnage of waste to the Lanchester Landfill from one of their transfer stations.

Materials to Manage

1. **Waste Source Reduction:**
    a. Product or material ban:
        i. Single-use plastic bags – each municipality should decide if they want to limit the distribution of plastic bags at the point of sale.
        ii. Single-use expanded polystyrene (EPS) - each municipality should decide if they want to limit the distribution of EPS at the point of sale.

2. **Materials Procurement:**
    a. CCSWA has set standards for the procurement of materials and equipment:
        i. Low Sulphur diesel fuel
        ii. Recycled content in copy paper
        iii. Efficient heavy equipment
        iv. Energy-efficient on-road vehicles

3. **Recyclables Collected at Curbside –** CCSWA administers the Processing and Marketing Contract that has minimum requirements for materials collected:
    a. Metal cans, bottles and jars
    b. Corrugated cardboard
    c. Mixed paper
    d. Plastics 1-7

4. **Recyclables Collected at Drop-Off Locations:**
    a. Lanchester Landfill's Small Load Facility:
        i. Metal cans, bottles and jars
        ii. Corrugated cardboard
        iii. Mixed paper
        iv. Plastics 1-7
        v. Electronic waste – covered devices – TV's, monitors, computers and peripherals
        vi. Fluorescent bulbs
        vii. Used clothes and shoes
        viii. Mixed metals
        ix. Antifreeze
        x. Cell phones
        xi. Rechargeable batteries
        xii. Clean towels, blanket and clothing
        xiii. Waste moor oil
        xiv. Used cooking oil
        xv. Newspapers
        xvi. Metal appliances – with or without refrigerant.
        xvii. Plastic bags
        xviii. Styrofoam

    b. Recycling Systems Inc. (North Coventry Township) – currently closed – proposed:
        i. Scrap metal
        ii. Aluminum cans
        iii. HDPE containers
        iv. PET containers

v. Glass bottles
vi. Cardboard

5. **Material Reuse:**
    a. CCSWA Permanent HHW (proposed) – paint, cleaning products, herbicides
    b. Construction and Demolition Debris (C&D) Recycling
        i. CCSWA's Lanchester Landfill is utilizing crushed concrete for roadway material
        ii. CCSWA will promote a C&D recycling facility to serve member communities

6. **Municipal Solid Waste:**
    a. Will continue to be disposed of at the Lanchester Landfill until an alternative disposal method is developed.
    b. CCSWA has hired GBB to help it evaluate alternative disposal methods.

7. **Yard Waste:**
    a. CCSWA promotes grasscycling
    b. CCSWA teaches back yard composting
    c. Lanchester Landfill Compost Area:
        i. Accepts yard waste
        ii. Accepts clean wood (pallets)
    d. CCSWA works with municipalities to develop their yard waste composting operations at the facilities they operate.

8. **Food Waste:**
    a. The Lanchester Service Area has one commercial food waste operation – Arborganic Acres in South Coventry Township
    b. CCSWA is considering anaerobic digestion as part of its interest in alternative disposal methods.

9. **Construction & Demolition Debris:**
    a. C&D is co-disposed at the Lanchester Landfill.
    b. C&D is accepted at two transfer stations in the Lanchester Service Area:
        i. Waste Management – Champion Transfer Station – 565 Trestle Place, Downingtown, PA 19335
        ii. Chris Eldredge Containers Transfer Station – 896 Fernhill Road, West Chester, PA 19380
    c. C&D from the Lanchester Service Area also taken to A.J. Blosenski's Conshohocken Recycling & Rail Transfer – 1600 Conshohocken Road, Conshohocken, PA 19428

10. **Household Hazardous Waste:**
    a. CCSWA's Recycling Resources Manager works with the Five-County Southeastern Pennsylvania Regional Group in planning about 30 one-day collection events per year. Chester County usually is host to five or six one-day events held in the spring through the fall.
    b. CCSWA is planning for a permanent facility to be located at the Lanchester Landfill.
    c.

Metrics

Measuring the performance of policies and procedures of this plan is crucial in determining if they are working. If we are not meeting timeline goals, then corrections need to be made.

1. **Disposal per capita**:
    a. Disposal tonnage per capita is the most crucial measure of the plan's success. The Lanchester Landfill Service Area has one of the fastest-growing populations in Pennsylvania. The trend over the last ten plus years has generally been a reduction in the generation of waste per capita.
    b. The numbers will be determined by waste receipts at the Lanchester Landfill and waste disposal numbers reported to the PADEP by other Pennsylvania facilities receiving waste from Chester County.
    c. The accuracy of the numbers could be increased if the C&D disposal from the Lanchester Service Area that utilize the three primary C&D transfer station could be obtained.

2. **Recycling per capita:**
    a. This number is not as critical as disposal per capita since the material is being further processed into new materials.
    b. Recycling material by its very nature can be highly variable due to market conditions and the changing composition of materials that are collected for recycling.

3. **Greenhouse Gas Reduction:**
    a. Greenhouse gas reduction can be calculated from the recycling tonnage – recycling items typically reduce greenhouse gas when compared to using raw materials.
    b. The reuse of materials is part of the calculation of the greenhouse gas reduction.
    c. Anaerobic digestion, yard waste composting (both backyard and commercial-scale) are also part of this measurement.
    d. Municipalities that go to a single waste hauler will also contribute to this reduction because they will eliminate multiple trucks driving on the same roads each week to collect waste, recyclable and yard waste.

Community Engagement

1. **Target Audience:**

    a. Residents that live in the Lanchester Service Area
    b. Elected Officials:
        i. Municipal Leaders
        ii. County Commissioners
    c. Key Municipal Officials:
        i. Municipal Recycling Coordinators
        ii. Code Enforcement
    d. Environmental Advisory Committees, and other local committees who support environmental initiatives
    e. Schools – Designated representatives who oversee facilities and custodial services
    f. Institutions (Colleges, Universities, Hospitals) - Designated representatives who oversee facilities and custodial services
    g. Businesses – through commercial organizations or Facility Managers in larger corporate offices

2. **Strategies to engage the Target Audience:**

    a. We have developed a Zero Waste Plan logo and a logo to recognize Partners level of achievement.

    b. Residents
        i. Targeted presentations, press releases and advertisements that advance zero waste principles such as waste hierarchy and collaborative consumption
        ii. Thirty-second advertisement for cable TV
        iii. Website:
            1. A page dedicated to Zero Waste – show metrics (such as annual disposal/capita) on this page
            2. Utilizing our Facebook account
            3. Utilizing our Twitter account
        iv. Smart phone application
        v. Utilize talent among residents as “ambassadors” of source reduction, such as experts in repairs, composting, reusing, natural alternatives to hazardous waste

    c. Elected Officials:

i. Municipal Leaders
    1. In-person or remote meetings in conjunction with meetings on recycling – CCSWA Recycling Resource Manager, Executive Director, Board Members
    2. Website information
    3. Recognition of achievements that demonstrate benefits of community efforts
ii. State representatives
    i. For support of favorable legislation in our region

d. Key Municipal Officials:
    1. In-person or remote electronic gatherings either with Municipal Leaders or separately
    2. Website information
    3. Recognition of achievements that demonstrate benefits of community efforts

e. Schools:
    i. Website information
    ii. In-person or remote meetings to encourage Facility Managers to conduct waste audits
    iii. Recognition of achievements that demonstrate benefits of school community's efforts

f. Institutions:
    i. Website information
    ii. In-person or remote meetings to encourage Facility Managers to conduct waste audits
    iii. Recognition of achievements that demonstrate benefits of staff's efforts

g. Businesses:
    i. Website information
    ii. In-person or remote meetings to encourage waste audits
    iii. Thirty-second advertisement for cable TV
    iv. Recognition of achievements that demonstrate benefits of employee efforts
    v. Business to business connections:
        1. Chambers of Commerce
        2. Chester County Economic Development Council

Milestones

1. Meet with all Chester County Municipal leaders to discuss the advantages of a single hauler system. Target Date: December 31, 2022 Personnel: Recycling Resources Manager with support from the Executive Director and Zero Waste Advisory Committee.

2. Meet with all Chester County Municipal leaders that don't have no burn ordinances to adopt a no burn ordinance. Target Date: December 31, 2022 Personnel: Recycling Resources Manager with support from the Executive Director and Zero Waste Advisory Committee.

3. Promote source reduction:
    a. Consumers and Municipalities:
        i. Information Campaign– Personnel: Recycling Resources Manager. Target Date: December 31, 2021.
        ii. Permanent Household Hazardous Waste Collection Facility – Personnel: CCSWA Engineering, Recycling Resources Manager and Executive Director. Target Date: December 31, 2022.
    b. Businesses: Personnel: Recycling Resources Manager, Executive Director, and Zero Waste Advisory Committee working with businesses, business associations, and the chamber of commerce. Target Date: December 31, 2022.
    c. Institutions: Personnel: Recycling Resources Manager and Executive Director. Target Date: September 1, 2023.

4. Material Reuse:
    a. Promote the reuse of materials:
        i. Permanent Household Hazardous Waste Facility. Personnel: Recycling Resources Manager and Executive Director. Target Date, December 31, 2022.
        ii. Coordinate with institutions such as Goodwill and Habitat for Humanity. Personnel: Recycling Resources Manager and Executive Director. Target Date, December 31, 2023.
    b. Provide a map on the CCSWA website for reuse and repair. Personnel: Recycling Resources Manager, Chester County GIS Department, and Executive Director. Target Date, December 31, 2022.

5. Recovered materials used as a feedstock: Clean wood - Personnel: Recycling Resources Manager and Executive Director. Target Date, December 31, 2022.

6. Recycle non-mandated materials:
    a. CCSWA Small Load Facility – ongoing.
    b. Recycling Systems Inc., North Coventry Township - Personnel: Recycling Resources Manager Engineering and Executive Director. Target Date, December 31, 2022.
    c. Public Education and business promotion - Personnel: Recycling Resources Manager and Executive Director. Target Date, December 31, 2022.

7. Organics and digestion – complete a feasibility study on constructing an in-vessel digestion facility. Personnel: GBB, Inc., Recycling Resources Manager, and Executive Director. Target Date, December 31, 2022.

8. Promote the use of proven, innovative recovery systems: Personnel: GBB, Inc., Recycling Resources Manager, Executive Director, and Zero Waste Advisory Committee. We plan to visit at least two facilities from our 2018 Request for Information. Target Date, December 31, 2022.

9. Promote the use of residuals as new materials. In 2021 CCSWA added auto shredder residue generated in Chester County as an alternate daily cover.

Zero Waste Grant Program

In April 2021 the CCSWA Board of Directors authorized $50,000 to support source reduction grants for nonprofit organizations.

1. Goals:
    a. Divert materials from the Lanchester Landfill
    b. Engage residents to increase source reduction
    c. Build partnerships
    d. Reduce environmental impacts
2. Eligible Applicants:
    a. Municipalities
    b. Nonprofit Organizations
    c. Public Schools
    d. Colleges and Universities
3. Grant Details:
    a. Applicants must demonstrate a 25% cash or in-kind contribution to the project
    b. Minimum grants is $500 and the maximum is $5,000
4. Evaluation of Applications:
    a. Project planning including the ability to complete the project in 12 months
    b. Measurable outcomes
    c. Sustainability of program for 2+years
    d. Weight and toxicity of materials reused??
    e. Need

Appendix A – Lanchester Service Area Municipalities

Atglen Borough
Birmingham Township
Caln Township
Charlestown Township
Coatesville City
Downingtown Borough
East Bradford Township
East Brandywine Township
East Caln Township
East Coventry Township
East Fallowfield Township
East Goshen Township
East Nantmeal Township
East Pikeland Township
East Vincent Township
East Whiteland Township
Easttown Township
Elverson Borough
Honeybrook Borough
Honey Brook Township
Malvern Borough
Modena Borough
North Coventry Township
Phoenixville Borough
Sadsbury Township
Schuylkill Township
South Coatesville Borough
South Coventry Township
Spring City Borough
Thornbury Township
Tredyffrin Township
Upper Uwchlan Township
Uwchlan Township
Valley Township
Wallace Township
Warwick Township
West Bradford
West Brandywine
West Caln Township
West Chester Borough
West Fallowfield Township
West Goshen Township
West Nantmeal Township
West Pikeland Township
West Sadsbury Township
West Vincent Township
West Whiteland Township
Westtown Township
Willistown Township

Appendix B – Chester County Solid Waste Authority's

Environmental Policy Statement

Chester County Solid Waste Authority provides assistance to area municipalities on developing and implementing waste reduction, recycling, leaf and yard waste composting and household hazardous waste programs in a manner that minimizes environmental impacts, conserves natural resources and provides effective stewardship of the environment.

We are committed to making environmental management an integral core value and vital part of our day to day operations at the Chester County Solid Waste Facility. Our goal is to help reduce the waste generated by residents, businesses, schools and institutions in Chester County and eventually become a Zero Waste Resource.

Chester County Solid Waste Authority is committed to excellence and leadership in protecting the environment and will strive to integrate our Environmental Management System (EMS) into our strategic planning processes.

Through our EMS we are dedicated to carrying out the following commitments:

Communication

Promote environmental awareness associated with waste minimization among our employees, customers and the public. Train, educated and inform our employees about our EMS and environmental issues that are part of their work. Our Policy will be communicated to employees, partner organizations and made available to the public.

Compliance

Comply with relevant environmental legislative, regulatory, permit and other requirements associated with our industry. We will implement programs and procedures to assure compliance.

Pollution Prevention

Identify and prevent or minimize pollution in all areas of our operations. We will look for opportunities to go beyond what is required by regulations when it is consistent with our strategic plan and available resources.

Continuous Improvement

Constantly look for ways to continually improve our environmental performance where reasonably practicable, by setting objectives and targets, primarily focused on waste reduction, efficient resource use, improved air and water quality and considering life cycle impacts associated with solid waste management.

We will measure and review our performance results annually and periodically report the results to our stakeholders.

Appendix C – Chester County Waste Characterization Study 2016

Final Report
March 30, 2016

Chester County, Pennsylvania
Solid Waste Characterization Study

Prepared for:
Chester County Solid Waste Authority

Prepared by:
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1. Introduction

Gershman, Brickner & Bratton, Inc. (GBB) was engaged by Chester County, Pennsylvania (County) to perform a two-season waste characterization study (Study) to support the 2015 Solid Waste Management Plan update. A two-season approach was used to study the effects of seasonal impacts, such as the growing season, tourism, and transient residents. The Study will be used to estimate the amount and type of material discarded as waste from Chester County residents and businesses each year, the percent of Chester County's "waste" stream that could be diverted away from disposal, and which specific discards from the residential and commercial sectors make up that potential diversion percentage.

The first study was conducted during the warm season starting in late May 2015 and finishing in early June 2015; and the second study was conducted during the cold season starting in late October 2015 and finishing in early November 2015. The Study was conducted at both the Chester County Solid Waste Authority's (CCSWA) Lanchester Landfill, and the Southeastern Chester County Refuse Authority (SECCRA) Community Landfill. Two weeks' worth of sorting (one week per season) were conducted in order to ensure that representative sampling of the community was achieved.

GBB conducted the Study in accordance with the American Society for Testing and Materials (ASTM) Method D5231-92, Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste.

This final report provides a summary of the Study methodology, the warm and cold season waste characterization results, combined results, data analysis, conclusions and recommendations.

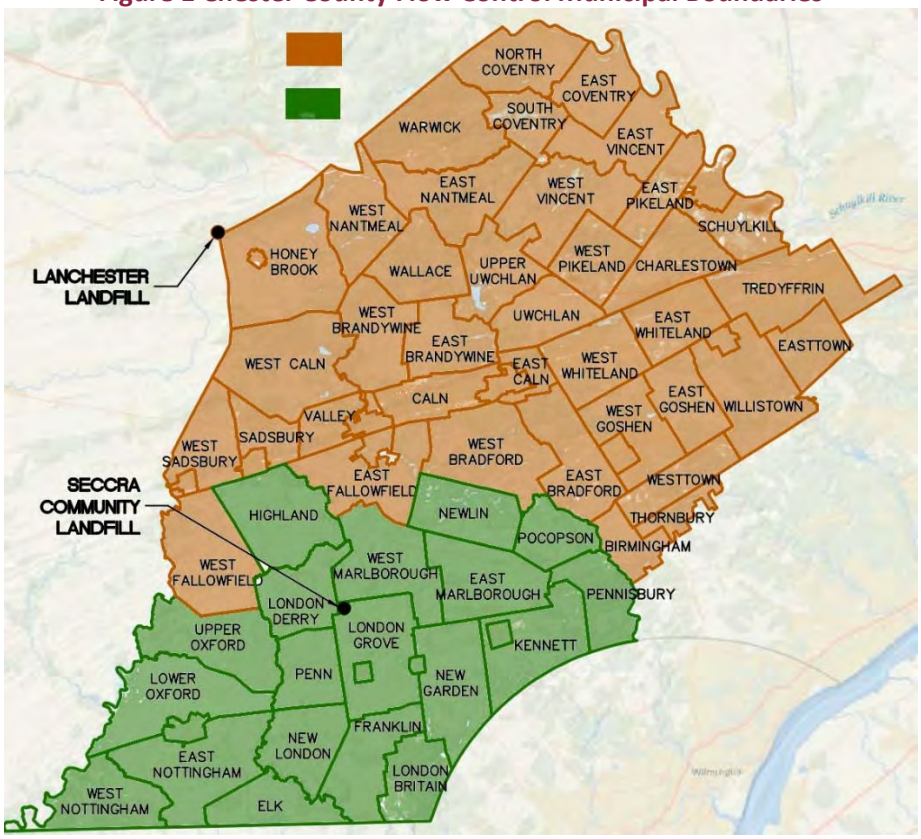
2. Background on Chester County

Chester County is located in eastern Pennsylvania, just west of the City of Philadelphia. The County is approximately 750 square miles and has a population of about 500,000, according to 2014 U.S. Census data.

Within Chester County there are two landfills that receive solid waste: the CCSWA Lanchester Landfill, and the SECCRA Community Landfill. The Lanchester Landfill receives waste from about 400,000 of the residents in the County, and the SECCRA Community Landfill receives waste from nearly 100,000 residents.

The municipal solid waste (MSW) generated in the County is flow controlled to either the Lanchester or SECCRA landfills. 49 municipalities are flow controlled to the Lanchester Landfill, and 24 municipalities are flow controlled to the SECCRA Community Landfill. Figure 1 shows which municipalities flow to each of the two landfills.

Figure 1 Chester County Flow Control Municipal Boundaries



Construction and demolition debris (C&D) and residual industrial wastes are not flow controlled. Additionally, there are agreements with certain haulers to allow them to dispose of waste at facilities outside of the County, provided they bring an equal amount of out-of-county waste to be disposed at the Lanchester and SECCRA landfills.

Chester County has an active recycling program that is implemented by both the public and private sectors In FY 2014, the County recycled over 10,000 tons of recyclable materials yielding just over a 15 percent recycling rate. This Study will provide feedback on opportunities to improve recycling in Chester County.

3. Waste Characterization Study Methodology

3.1. Study Design and Methodology

Because of the heterogeneous nature of solid wastes, determination of the composition requires specific processes and procedures. Waste composition information has widespread applications and can be used for activities such as solid waste planning, evaluating recycling program effectiveness, facility design, and for determining reference waste composition in facility contracts and acceptance test plans.

Waste characterization studies are often performed at disposal facilities, such as landfills, or intermediate management facilities, such as transfer stations. For this Study, the characterization was determined after collection and at the final disposal site(s), i.e. the CCSWA Lanchester Landfill and the SECCRA Community Landfill.

3.1.1. Residential MSW Characterization

For this Study, the residential municipal solid waste (MSW) was characterized according to ASTM D5231 (2008) Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste. ASTM Standard D5231 outlines the procedures for the:

- Collection of a representative sorting sample of unprocessed MSW;
- Manual sorting of the MSW into individual waste components;
- Data analysis; and,
- Data reporting.

ASTM Standard D5231 recommends a sample size of 200 to 300 lbs. The number of samples required to be sampled and sorted (n) to achieve a desired level of measurement precision is a function of the component(s) under consideration and the confidence level. The governing equation for n is as follows:

$$n = (t^*s/e^*\bar{x})^2$$

Where:

t* = student t statistic corresponding to the desired level of confidence,
s = estimated standard deviation,
e = desired level of precision, and
$\bar{x}$ = estimated mean.

The initial resultant number of samples and the re-calibrated number of samples are shown in Table 1 (n^o and n').

Table 1 - ASTM D5231 Determination of Number of Samples

INPUTS	
t(90%,∞)	1.645
t(90%, 51)	1.676
$\bar{x}$	140%
e	10%
s	6%
OUTPUTS	
n^o	**50**
n'	**52**
weight (lb)	**10,319**

Only one sorting sample is chosen per vehicle load. Therefore, for this Study, each field program needed to sort approximately 50 to 52 samples comprising approximately 10,319 lbs.

GBB used a systematic selection procedure to identify the vehicles for sampling. Systematic, stratified sampling is intended to remove any sampling bias that may arise from an individual selecting specific incoming vehicles. To remove such bias, for each generator class, the total number of incoming trucks from each source (residential, commercial, industrial) was divided by the number of samples needed for that source for that day. The resulting number was the sampling frequency and determines which vehicle will be selected for sampling. This strategy is known as the "Nth Truck" approach.

To provide useful information about waste composition, GBB specifically looked at identified communities that represent urban, suburban, and rural areas of the County. GBB sampled materials from (urban) Coatesville, Kennett Square Borough, Phoenixville, (suburban) East Marlborough, Tredyffrin, (rural) West Caln, and East Nottingham. As most collection throughout the County is subscription or open market service, many haulers collect from more than one community on a single route.

Sample identification was also conducted using a systematic approach to minimize bias in the Study. The dumped waste load will form a rough oval, which was visually divided into a grid as shown in Figure 2. The first sort will be performed in grid cell number 1, and each progressive sort will proceed in order through cell number 6, starting over once all are completed. Once waste samples were obtained, they were carried to the sorting area (see Figure 3).

Figure 2 Waste Load Sample Selection Procedure

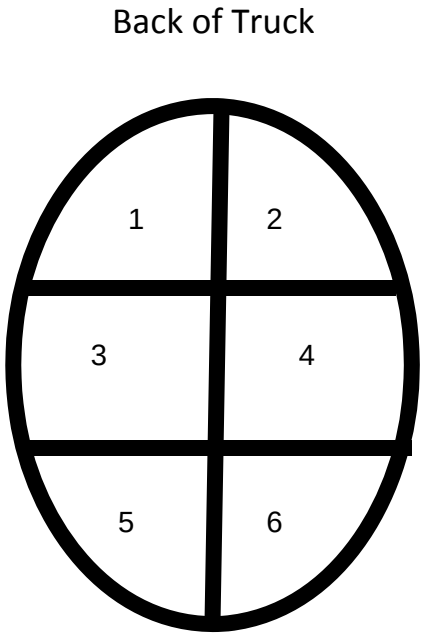


Figure 3 Waste Sampling

Waste samples were sorted into 24 material categories. The list shown in Table 2 were used for residential MSW characterization. Definitions of each material category are provided in Appendix A – Definitions of Waste Categories.

GBB provided a large canopy tent over the sorting area to protect the workers and sorting samples from the elements. Each sort area layout, as shown in Figure 4, consisted of three separate sub-areas:

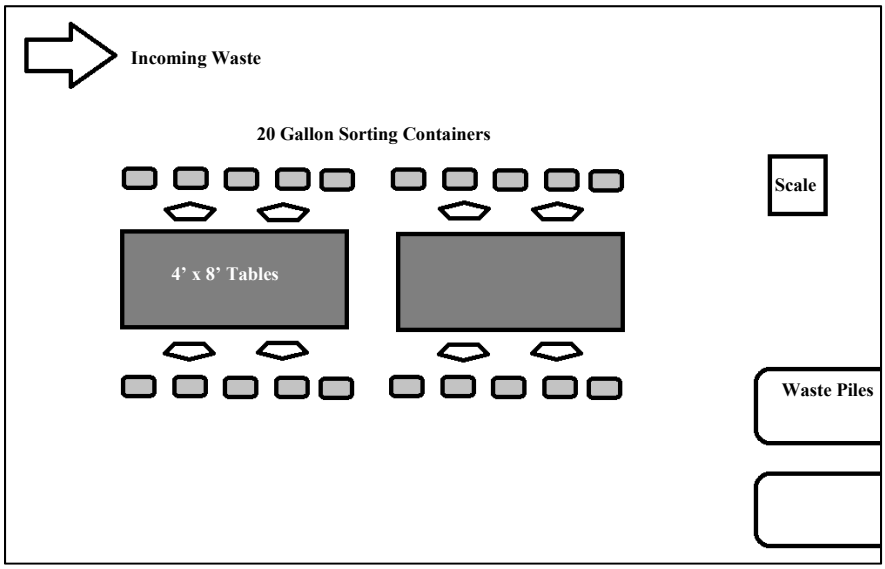
- Incoming Waste Area;
- Sorting Table Area; and
- Scale Area.

The two sorting tables were arranged side-by-side, with the sorting containers arranged around the border of the tables. The sorting containers were labeled and grouped by material type (paper, plastics, metals, etc.

Table 2 - Sort Material Categories

Category	Sort Material List	#
Paper	Newsprint	1
	Office Paper	2
	Other Recyclable Paper	3
	Corrugated Cardboard, Kraft Paper	4
	Other Non-Recyclable Paper	5
Plastic	PET (#1)	6
	HDPE (#2)	7
	Rigid Plastic (#3-#7)	8
	Other Plastic	9
Glass	Bottles and Jars	10
	Other Glass	11
Metals	Aluminum	12
	Steel Cans	13
	Other Ferrous Metals	14
	Other Non-Ferrous Metals	15
Organics	Yard Waste	16
	Food Waste	17
	Other Organics	18
Other	Textiles	19
	Special Wastes	20
	Electronic Waste	21
	Bulky Waste	22
	C & D	23
	Other	24

Figure 4 - Sort Area Layout



After the residential MSW sample was brought to the sorting area, it was dumped onto sorting tables. All bags and other containers in the sample were opened and all contents sorted into the sorting containers surrounding the tables. Sorters were tasked to specialize in certain material groups based on where they are positioned around the table: one for the paper categories, another plastic, another glass and metals, etc. In this way, sorters become knowledgeable in a short period of time as to the characteristics of their individual material category. Figure 5 is a photograph of the sorting operation.

Quality of the sorted material containers was monitored as each sample was sorted, reclassifying (and pointing out to the sorters) materials that were improperly classified. The materials on the sort tables were manually sorted until a mixed remainder of minus two-inch "Fines" material was left. The Fines were allocated to the appropriate categories based on the best judgment of the Field Supervisor. The goal was to maximize the sorting of samples into component categories and reduce the remainder.

When all materials from a sample were sorted, the sorting workers carried the sorting containers to the scale to be weighed. The Field Supervisor used the Waste Composition Data Recording Sheet (see Appendix B) to record the weights of each container filled with each material category. When each container had been weighed, the sorting workers dumped the materials in a designated area next to the working face so the material could be pushed (by landfill staff) into the landfill.

Figure 5 Photograph of the Sorting Operation

3.1.2. Bulky Waste Characterization

The procedure for characterizing MSW is different from the method used to characterize bulky waste or construction and demolition debris (C&D). The reason for the different approaches is based on the difficulty in physically sorting large bulky materials typically found in C&D.

Bulky waste loads were visually inspected and their composition was estimated by volume estimates and composition material densities. Table 3 shows the material category list to be used for the visual survey of bulk material loads.

Bulky waste truck drivers were interviewed to obtain information such as origin of the load, waste generating source, hauler, vehicle type and number, and other data. The bulky waste truck's capacity was also noted so that Specific Weight calculations could be made.[1] This information was noted on the Bulky Load Visual Survey Form, along with a unique identifying number associated with that vehicle on that day. A copy of the Bulky Load Visual Survey Form is provided as Appendix C.

[1] This data is sometimes referred to as "Bulk Density" but Specific Weight is the proper term.

Table 3 - Bulk Material Categories

Category	Material
Paper	OCC
	Other Paper
Bagged MSW	Residential Household Trash
Metal	Ferrous
	Nonferrous
Yard Waste	All
Wood	Treated Wood
	Untreated Wood
Plastic	Plastic (all types, any items)
Inert	Concrete/Asphalt/Block/Stone/Dirt/Sand/Glass
Drywall/Insulation	Renovation & Demolition Materials
Asphalt Shingles	Asphalt Shingles and Tar Paper
Carpets/Padding	Carpets, Padding, and Trimmings
Furniture/Mattresses	Couches, Tables, Chairs, Beds, Mattresses
Other	Tires, Fines, Other Unclassified

3.2. Field Work Schedule

The field work for the Study was conducted over two seasons: a warm season and a cold season. The warm season field work took place between May 27, 2015 and June 2, 2015. The cold season field work took place between October 28, 2015 and November 3, 2015.

Waste sampling and sorting took place during the working hours of both landfills. The Lanchester landfill is open for waste deliveries from 6AM until 5PM during the week, and 7AM to noon on Saturdays. The SECCRA landfill is open for waste deliveries from 7AM until 4PM during the week, and 8AM to noon on Saturdays. Both landfills are closed on Sundays.

3.3. Field Staff

The primary personnel involved in the field program included the following:

- **Field Supervisor.** The Field Supervisor had lead responsibility for planning the sampling and sorting work, and for interacting with the landfill personnel throughout the field data collection. The Field Supervisor managed the sorting area, sorting productivity and accuracy, data recording, and cleaning up at the end of the day. Elizabeth Rice and Bradley Kelly from GBB performed these functions.
- **Health and Safety Supervisor.** The Health and Safety Supervisor was responsible for managing work site health and safety, and served as backup to the Field Supervisor in managing the sorting area, sorting productivity and accuracy, data recording, and cleaning up at the end of the day. Eric Weiss from GBB performed this function.

- **Sorting Labor.** Ten (10) laborers from the area manually sorted the incoming material into individual materials and brought sample buckets from the tipping area to the sort tables. GBB utilized workers from LaborReady Staffing in Lancaster. The majority of the sort crew remained consistent throughout every day of the study.

3.4. Lanchester Landfill Sorting Site Layout

The Lanchester Landfill is located at 7224 28th Division Highway, Narvon, PA. The site manager provided GBB with an area to conduct the Study on the working face of the landfill. The working face is the highest point in the county, as shown in Figure 6 and takes about five minutes to reach from the scale-house entrance.

Figure 6 Lanchester Landfill Working Face

Waste hauling trucks enter the landfill through the scale-house entrance to make their way up to the working face of the landfill. Driving up the winding, gravel road, trucks would reach the top and drive about a quarter of a mile across it to the tipping area. After tipping their loads, the compactor would move the material into that day's waste pile. The site layout is provided in Figure 7 and a photograph of the study area is provided in Figure 8.

The working face of the landfill is subject to intensified weather conditions such as strong gusts of wind and sun exposure. To ensure the health and safety of the Study team, GBB rented an in-ground staked tent from a local tent company, Tents for Rent LLC. Additionally, GBB rented a portable toilet and a hand wash station.

Figure 7 Lanchester Landfill Site Layout

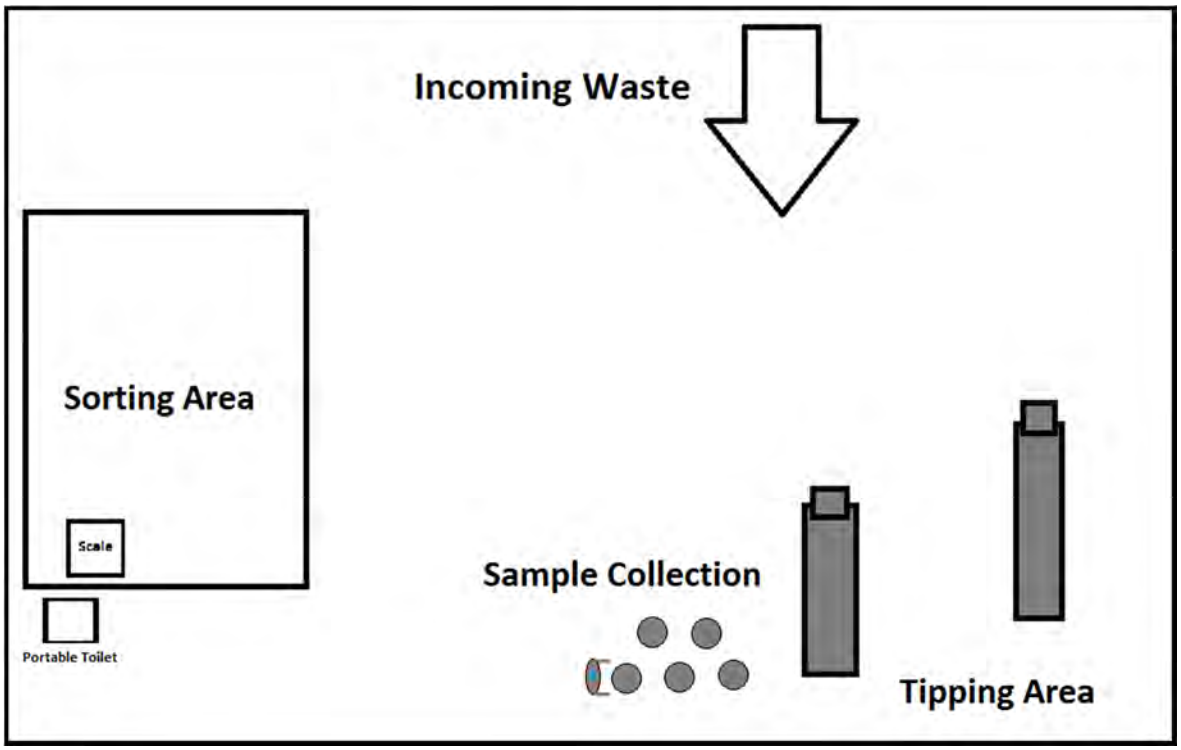


Figure 8 Lanchester Study Area

3.5. SECCRA Landfill Sorting Site Layout

The SECCRA Landfill is located at 219 Street Road, West Grove, PA. The site manager provided GBB with a space to conduct the sort on the working face of the landfill. The SECCRA Landfill's working face is at ground level, and takes about three minutes to reach from the scale-house entrance as seen in Figure 9.

Waste hauling trucks and pick-up trucks enter the landfill through the scale-house entrance to make their way to the working face of the landfill. Driving along the gravel road, trucks would reach the working face of the landfill, and drive a short distance to the tipping area. After tipping their loads, a track loader would push the material towards the working face where the compactor would compact the waste. The site layout is pictured in Figure 10.

Since the working face of the SECCRA landfill is at ground level, the weather conditions are milder and there was less wind than at the Lanchester Landfill Study site. However, GBB purchased a canopy tent to provide workers shade and provide cover during precipitation as shown in Figure 11.

Figure 9 SECCRA Landfill Working Face

Figure 10 SECCRA Landfill Site Layout

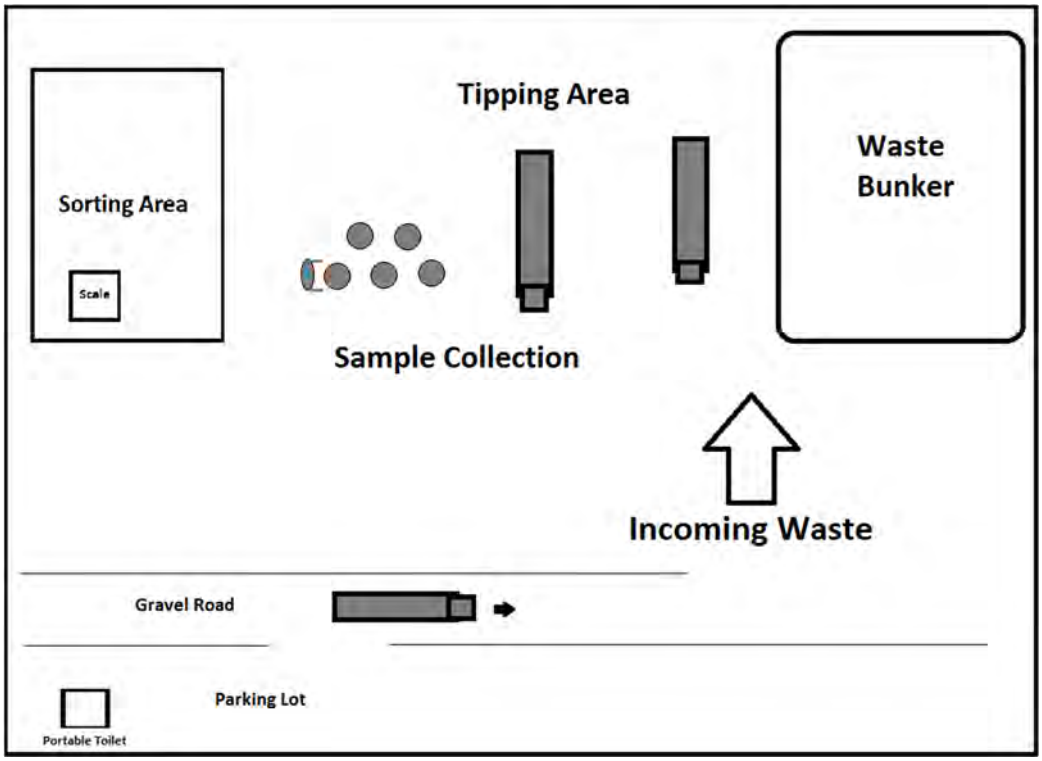


Figure 11 SECCRA Landfill Sort Area

3.6. Weather

Chester County weather was generally favorable during the Study. On a few days, there was adverse weather conditions that had an impact on the study, including high winds and rain. This caused the landfill working face to become muddy and caused blowing of debris. However, the tent provided shelter for the workers and samples and prevented the wind or rain from impacting sorting procedures.

The weather during the warm season of the Study is shown in Table 4.

Table 4 - May 27 through June 2 Chester County Weather Data[2]

	May 2015				June 2015	
Date	27 Wed	28 Thu	29 Fri	30 Sat	1 Mon	2 Tue
Avg. Temp (°F)	76	78	77	71	69	55
Weather Condition	Wind, Sun	Sun	Sun	Sun	Partial Sun	Rain, Overcast

The weather during the cold season of the Study is shown in Table 5.

Table 5 - October 28 through November 3 Chester County Weather Data[2]

	October 2015				November 2015	
Date	28 Wed	29 Thu	30 Fri	31 Sat	2 Mon	3 Tue
Avg. Temp (°F)	60	60	47	45	53	56
Weather Condition	Overcast, Rain, Wind	Overcast, Rain	Sun, Wind	Sun	Sun, Light Wind	Sun, Light Wind

4. Data Summary

GBB exceeded the required number of sorts and sample weight to achieve a 90 percent confidence level for the Study. Table 6 documents the samples taken from the warm weather sort and Table 7 documents the samples taken from the cold weather sort.

As GBB compiled data from this Study, staff also analyzed various aspects of the sorted samples, including comparing waste sorted from different communities and generator types within the County. When GBB went to sample from a truck, the Field Supervisor or Health and Safety Supervisor who was supervising the sort asked the driver of the truck what communities the waste had come from. This information and the truck identifying numbers were cross-referenced with the information presented on the manifest

[2] http://www.wunderground.com, Widner Observatory, KPACHEST4 Weather Station

forms submitted at the scale when the vehicles entered the facility and reports generated by the scale house data recording software.

Table 6 - Samples Taken During Warm Weather Sort

Day	No. Samples	Total Net (lb.)	Average Weight per Sample (lb.)
May 27	10	1,770.6	177.1
May 28	12	2,601.9	216.8
May 29	10	2,727.2	272.7
May 30	6	1,533.7	255.6
June 1	10	2,354.5	235.5
June 2	10	2,470.1	247.0
Total	58	13,458.0	232.0

Table 7 - Samples Taken During the Cold Weather Sort

Day	No. Samples	Total Net (lb.)	Average Weight per Sample (lb.)
October 28	5	818.5	163.7
October 29	12	2,275.8	189.6
October 30	13	2,134.1	164.2
October 31	5	951.0	190.2
November 2	10	2,105.4	210.5
November 3	12	2,419.9	201.7
Total	57	10,704.8	187.8

Table 8 shows warm season summary data of material category distribution for all samples sorted. Table 9 shows the cold season summary data of material category distribution for all samples sorted. Table 10 and **Error! Reference source not found.** shows the combined weighted average Study results.

Table 8 – Warm Season Waste Characterization Study Results (lbs.)

	Lanchester Landfill				SECCRA Landfill			
Day/Material	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Monday**	**Tuesday**	**Total Weight**	**% by Weight**
Organics							**3,758.2**	**28.0%**
Food	241.2	348.0	343.8	218.4	370.7	320.4	1,842.5	13.7%
Leaves and Brush	159.0	216.2	328.1	156.2	184.2	198.8	1,242.5	9.3%
Misc. Organics	104.0	157.0	124.2	125.8	65.4	96.8	673.2	5.0%
Paper							**3,504.5**	**26.1%**
OCC	91.3	110.0	74.8	29.2	107.0	101.0	513.3	3.8%
Office Paper	10.8	18.8	44.4	13.8	5.3	92.6	185.7	1.4%
Newsprint	37.8	48.1	49.4	28.4	14.0	35.9	213.6	1.6%
Other Recyclable Paper	149.2	109.6	140.2	114.6	167.0	202.2	882.8	6.6%
Other Non-Recyclable Paper	155.0	349.2	456.4	195.2	239.7	313.6	1,709.1	12.7%
Glass							**381.4**	**2.8%**
Bottles and Jars	27.4	52.4	38.8	58.6	68.6	53.0	298.8	2.2%
Other Glass	20.4	16.0	10.6	15.4	7.6	12.6	82.6	0.6%
Plastics							**2,250.1**	**16.8%**
HDPE	13.4	42.2	27.2	19.0	19.2	36.4	157.4	1.2%
PET	31.8	65.8	52.0	25.6	75.6	76.2	327.0	2.4%
Mixed Plastic (Rigid)	153.6	146.8	97.2	57.8	113.8	99.8	669.0	5.0%
Other Plastic (Flexible)	126.3	209.8	185.2	115.6	238.4	221.4	1,096.7	8.2%
Metal							**298.2**	**2.2%**
Aluminum Cans	12.4	23.8	27.6	10.4	22.6	20.8	117.6	0.9%
Steel Cans	13.8	19.8	11.4	11.2	18.8	10.6	85.6	0.6%
Other Non-Ferrous	2.0	10.6	2.2	0.6	7.4	9.6	32.4	0.2%
Other Ferrous	9.0	7.2	18.2	7.4	10.8	10.0	62.6	0.5%
Other							**1,908.8**	**14.2%**
Textiles	75.4	106.0	270.7	105.8	229.6	173.4	960.9	7.2%
Special	11.4	52.2	15.6	8.0	12.0	81.0	180.2	1.3%
Electronics	61.6	29.4	34.0	21.8	21.2	14.6	182.6	1.4%
C&D	8.8	190.2	132.2	64.1	91.4	98.4	585.1	4.4%
Fines							**1,316.8**	**9.8%**
Other/Residue	255.0	272.8	243.0	130.8	264.2	191.0	1,316.8	9.8%
Total	**1,770.6**	**2,601.9**	**2,727.2**	**1,533.7**	**2,354.5**	**2,470.1**	**13,418.0**	**100.0%**

Table 9 – Cold Season Waste Characterization Study Results (lbs.)

	Lanchester Landfill				SECCRA Landfill			
Day/Material	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Monday**	**Tuesday**	**Total Weight**	**% by Weight**
Organics							**2,889.2**	**27.0%**
Food	114.0	427.6	265.8	159.8	343.9	401.2	1712.3	16.0%
Leaves and Brush	41.0	113.2	156.6	51.3	95.3	322.2	779.6	7.3%
Misc. Organics	14.2	61.5	123.6	29.8	81.6	86.6	397.3	3.7
Paper							**2,721.5**	**25.4%**
OCC	25.4	55.3	106.4	61.3	113.0	117.5	478.9	4.5%
Office Paper	5.6	13.6	32.4	4.9	23.2	13.3	93.1	0.9%
Newsprint	22.3	12.1	14.1	15.3	12.6	21.1	97.5	0.9%
Other Recyclable Paper	57.7	125.0	134.1	24.8	95.2	126.9	563.8	5.3%
Other Non-Recyclable Paper	131.4	324.0	297.2	177.6	276.4	281.6	1,488.2	13.9%
Glass							**277.5**	**2.6%**
Bottles and Jars	25.9	70.7	40.3	18.6	42.9	34.2	232.6	2.2%
Other Glass	0.5	10.9	13.4	0.0	12.6	7.6	44.9	0.4%
Plastics							**1,506.8**	**14.1%**
HDPE	12.8	19.8	14.0	11.0	26.0	38.8	122.3	1.1%
PET	35.2	38.0	41.7	20.7	29.2	28.6	193.4	1.8%
Mixed Plastic (Rigid)	39.2	63.1	63.2	29.7	45.0	44.2	283.4	2.6%
Other Plastic (Flexible)	101.1	194.6	170.3	89.0	137.8	214.8	907.6	8.5%
Metal							**421.7**	**3.9%**
Aluminum Cans	5.8	12.6	7.5	4.2	9.0	14.5	53.5	0.5%
Steel Cans	12.1	18.3	15.4	7.8	27.5	17.9	98.9	0.9%
Other Non-Ferrous	1.7	13.0	14.4	9.4	16.4	8.7	63.6	0.6%
Other Ferrous	6.8	36.9	65.5	12.6	34.2	49.7	205.7	1.9%
Other							**2,269.9**	**21.2%**
Textiles	68.9	220.7	177.4	37.3	227.2	211.0	942.3	8.8%
Special	3.4	59.0	63.4	13.2	53.0	83.4	275.2	2.6%
Electronics	8.7	51.8	88.2	23.6	156.0	66.6	394.9	3.7%
C&D	19.3	193.9	101.3	83.3	134.2	125.4	657.4	6.1%
Fines							**618.2**	**5.8%**
Other/Residue	65.4	104.4	128.0	66.8	113.2	104.4	618.2	5.8%
Total	**818.5**	**2,275.8**	**2,134.1**	**951.0**	**2,105.4**	**2,419.9**	**10,704.8**	**100.0%**

Table 10 – Combined Season Waste Characterization Study Results

Material	% by Weight
Organics	**27.5%**
Food	14.7%
Leaves and Brush	8.4%
Misc. Organics	4.4%
Paper	**25.8%**
OCC	4.1%
Office Paper	1.2%
Newsprint	1.3%
Other Recyclable Paper	6.0%
Other Non-Recyclable Paper	13%
Glass	**2.7%**
Bottles and Jars	2.2%
Other Glass	0.5%
Plastics	**15.5%**
HDPE	1.2%
PET	2.2%
Mixed Plastic (Rigid)	3.9%
Other Plastic (Flexible)	8.3%
Metal	**3.0%**
Aluminum Cans	0.7%
Steel Cans	0.8%
Other Non-Ferrous	0.4%
Other Ferrous	1.1%
Other	**17.3%**
Textiles	7.9%
Special	1.9%
Electronics	2.4%
C&D	5.1%
Fines	**8.2%**
Other/Residue	8.2%
Total	**100.0%**

Table 12 shows the sorted waste composition of the materials by generator.

Table 11 – Combined Season Material Breakdown by Demographic

Category	Urban Communities	Suburban Communities	Rural Communities
Food	16%	15%	12%
Leaves and Brush	8%	8%	8%
Misc. Organics	3%	5%	3%
OCC	5%	4%	6%
Office Paper	1%	1%	0%
Newsprint	1%	1%	2%
Other Recyclable Paper	6%	6%	7%
Other Non-Recyclable Paper	14%	13%	16%
Bottles and Jars	3%	2%	2%
Other Glass	1%	1%	0%
HDPE	1%	1%	2%
PET	3%	2%	2%
Mixed Plastic (Rigid)	4%	4%	4%
Other Plastic (Flexible)	9%	8%	9%
Aluminum Cans	1%	1%	1%
Steel Cans	1%	1%	1%
Other Non-Ferrous	1%	0%	0%
Other Ferrous	1%	1%	1%
Textiles	7%	9%	6%
Special	2%	2%	3%
Electronics	2%	3%	2%
C&D	4%	5%	4%
Other/Residue	8%	8%	9%
Total	100%	100%	100%

Table 12 – Combined Season Material Breakdown by Generator*

Category	Commercial	Residential
Food	13%	16%
Leaves and Brush	5%	10%
Misc. Organics	4%	5%
OCC	5%	3%
Office Paper	2%	1%
Newsprint	1%	1%
Other Recyclable Paper	5%	6%
Other Non-Recyclable Paper	15%	12%
Bottles and Jars	2%	2%
Other Glass	0%	1%
HDPE	2%	1%
PET	3%	2%
Mixed Plastic (Rigid)	4%	3%
Other Plastic (Flexible)	11%	7%
Aluminum Cans	1%	1%
Steel Cans	1%	1%
Other Non-Ferrous	0%	0%
Other Ferrous	1%	1%
Textiles	6%	9%
Special	2%	2%
Electronics	3%	3%
C&D	5%	5%
Other/Residue	8%	8%
Total	100.0%	100.0%

***Based on available data**

Bulky waste surveys for the warm season are presented in Table 13 and cold season bulky waste survey are presented in Table 14. The combined season bulky waste surveys are presented in Table 15 and **Error! Reference source not found.**.

Table 13 – Warm Season Bulk Survey Summary Results

	Lanchester Landfill		SECCRA Landfill			
Category	**Tons**	**%**	**Tons**	**%**	**Total Tons Surveyed**	**Overall Percentage**
OCC	28.0	22.8%	2.3	6.1%	30.3	18.8%
Other Paper	0.4	0.4%	0.0	0.0%	0.4	0.3%
Bagged MSW	10.4	8.5%	3.5	9.2%	13.9	8.6%
Ferrous Metal	0.2	0.1%	2.0	5.3%	2.2	1.4%
Nonferrous Metal	1.1	0.9%	0.3	0.7%	1.4	0.9%
Yard Waste	0.0	0.0%	5.7	14.8%	5.7	3.5%
Untreated Wood	28.5	23.3%	11.7	30.8%	40.3	25.1%
Treated Wood	5.2	4.2%	4.2	10.9%	9.3	5.8%
Plastic	14.4	11.7%	4.1	10.7%	18.5	11.5%
Inert	0.3	0.3%	0.0	0.0%	0.3	0.2%
Drywall/Insulation	2.0	1.6%	3.6	9.5%	5.6	3.5%
Asphalt Shingles	25.6	20.8%	0.0	0.0%	25.6	15.9%
Carpets/Padding	0.3	0.2%	0.4	1.0%	0.7	0.4%
Furniture/Mattresses	6.4	5.2%	0.3	0.8%	6.7	4.2%
Other	0.0	0.0%	0.0	0.0%	0.0	0.0%
Total	**122.8**	**100.0%**	**38.2**	**100.0%**	**160.9**	**100.0%**

Note: Numbers may not add exactly due to round-off error

Table 14 – Cold Season Bulk Survey Summary Results

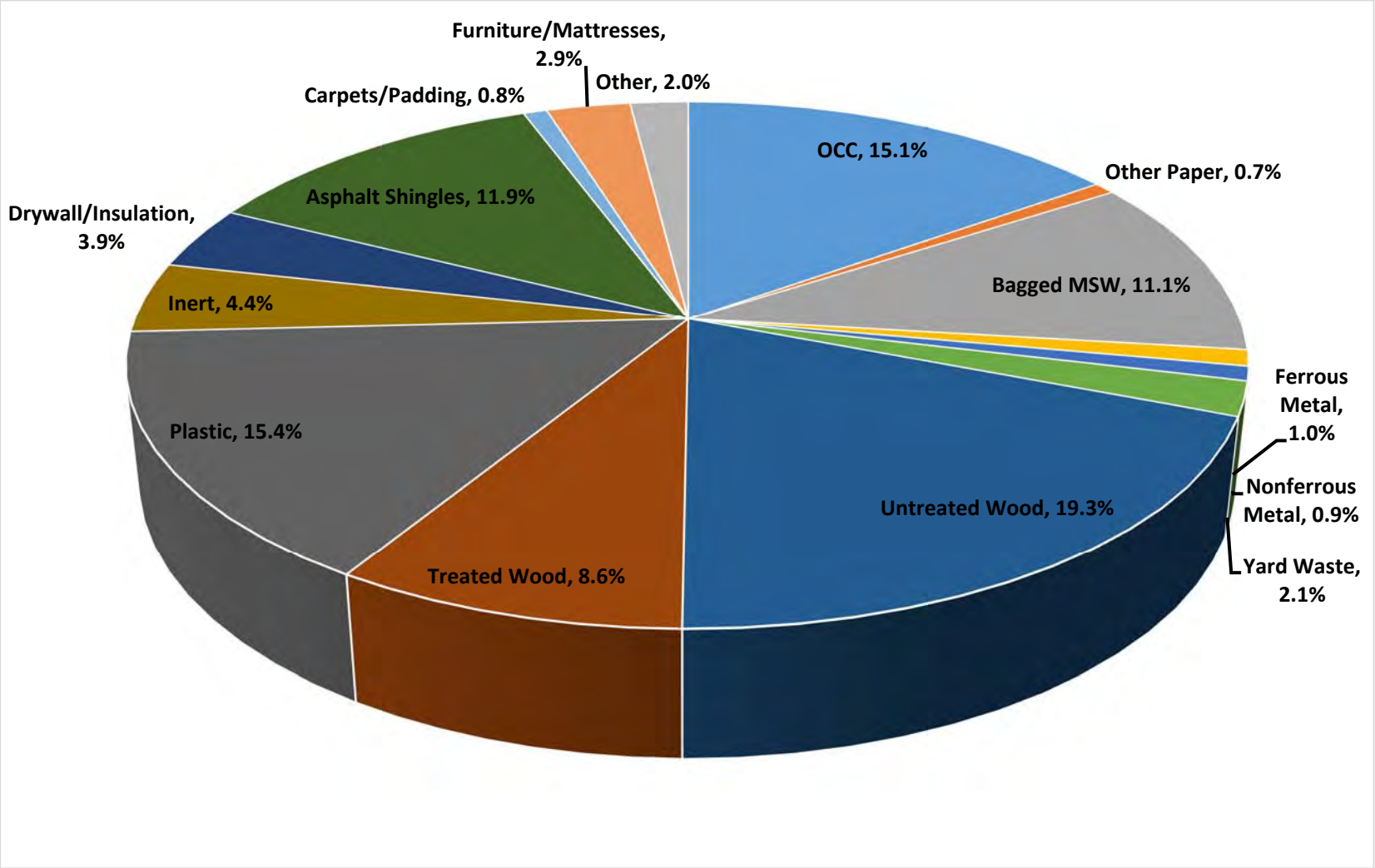
	Lanchester Landfill		SECCRA Landfill			
Category	**Tons**	**%**	**Tons**	**%**	**Total Tons Surveyed**	**Overall Percentage**
OCC	3.0	7.5%	8.0	11.1%	11.0	9.8%
Other Paper	1.6	4.1%	0.0	0.0%	1.6	1.5%
Bagged MSW	8.6	21.4%	7.7	10.7%	16.3	14.5%
Ferrous Metal	0.0	0.0%	0.5	0.7%	0.5	0.4%
Nonferrous Metal	1.0	2.4%	0.0	0.0%	1.0	0.9%
Yard Waste	0.0	0.0%	0.0	0.0%	0.0	0.0%
Untreated Wood	3.3	8.3%	9.0	12.5%	12.4	11.0%
Treated Wood	5.8	14.3%	8.6	11.9%	14.3	12.7%
Plastic	3.1	7.7%	20.5	28.4%	23.6	21.0%
Inert	4.9	12.2%	6.7	9.3%	11.6	10.3%
Drywall/Insulation	3.6	9.0%	1.4	1.9%	5.0	4.5%
Asphalt Shingles	1.5	3.8%	5.5	7.6%	7.0	6.2%
Carpets/Padding	1.2	3.0%	0.3	0.4%	1.5	1.3%
Furniture/Mattresses	1.0	2.5%	0.1	0.1%	1.1	1.0%
Other	1.5	3.7%	3.9	5.4%	5.4	4.8%
Total	**40.2**	**100.0%**	**72.2**	**100.0%**	**112.3**	**100.0%**

Note: Numbers may not add exactly due to round-off error

Table 15 – Combined Season Bulk Survey Summary Results

Category	Overall Percentage
Paper	**15.8%**
OCC	15.1%
Other Paper	0.7%
Bagged MSW	**11.1%**
Metals	**1.9%**
Ferrous Metal	1.0%
Nonferrous Metal	0.9%
Yard Waste	**2.1%**
Wood	**27.9%**
Untreated Wood	19.3%
Treated Wood	8.6%
Plastic	**15.4%**
Inert	**4.4%**
Drywall/Insulation	**3.9%**
Asphalt Shingles	**11.9%**
Carpets/Padding	**0.8%**
Furniture/Mattresses	**2.9%**
Other	**2.0%**
Total	**100.0%**

Figure 12 Combined Season Bulk Survey Summary Results



5. Analysis

One of the purposes of this study was to estimate the amount of recyclables in the solid waste disposed within Chester County. Using Chester County's standard list of recyclable items, Table 16 shows the annual (2014) amount of recyclables being disposed in Chester County.

GBB also analyzed the Study data to help understand how much of a material category is estimated to be originating from the urban, suburban and rural communities in Chester County. Using an estimated 2014 County-wide disposal amount of 257,633 tons, Table 17 show the amount of each material category disposed in the urban, suburban and rural communities in Chester County.

Table 16 Estimated Recyclables Disposed in Chester County (2014)

Category	Overall Percentage	Tons
OCC	4.2%	10,703
Office Paper	1.1%	2,908
Newsprint	1.3%	3,230
Other Recyclable Paper	5.9%	15,282
Bottles and Jars	2.2%	5,675
HDPE	1.2%	2,987
PET	2.1%	5,475
Mixed Plastic (Rigid)	3.8%	9,850
Steel Cans	0.8%	2,014
Other Non-Ferrous	0.4%	1,077
Total	**23.0%**	**59,202**

Table 17 Estimated Disposal Tonnage by Municipal Type and Material Category (2014)

Material Category	Urban	Suburban	Rural	Total TPY
Food	8,621	27,023	2,528	38,340
Leaves and Brush	4,204	14,328	1,634	21,341
Misc. Organics	1,829	9,016	648	11,261
OCC	2,545	6,922	1,303	10,703
Office Paper	460	2,513	104	2,908
Newsprint	702	1,942	501	3,230
Other Recyclable Paper	3,008	10,307	1,366	15,282
Other Non-Recyclable Paper	7,334	23,732	3,335	34,359
Bottles and Jars	1,498	3,797	393	5,675
Other Glass	279	1,106	35	1,335
HDPE	697	2,039	377	2,987
PET	1,385	3,837	440	5,475
Mixed Plastic (Rigid)	2,159	6,781	840	9,850
Other Plastic (Flexible)	4,933	14,871	1,764	21,140
Aluminum Cans	440	1,247	136	1,776
Steel Cans	431	1,494	173	2,014
Other Non-Ferrous	269	764	25	1,077
Other Ferrous	376	2,356	310	3,078
Textiles	3,971	15,817	1,254	20,589
Special	857	3,926	498	5,047
Electronics	1,108	5,146	350	6,509
C&D	2,255	9,801	910	13,543
Other/Residue	4,474	14,356	1,751	20,114
Total	**53,833**	**183,124**	**20,676**	**257,633**

Table 18 shows the estimated 2014 Chester County waste disposal tonnage broken down by commercial and residential sources.

Table 18 Estimated 2014 Disposal Tonnage by Commercial or Residential Origin and Material Category

Material Category	Commercial	Residential	Total TPY
Food	13,024	24,758	38,340
Leaves and Brush	5,093	16,100	21,341
Misc. Organics	3,987	7,276	11,261
OCC	5,533	5,248	10,703
Office Paper	1,892	1,130	2,908
Newsprint	1,134	2,160	3,230
Other Recyclable Paper	5,723	8,682	15,282
Other Non-Recyclable Paper	15,079	19,241	34,359
Bottles and Jars	2,365	3,427	5,675
Other Glass	313	1,083	1,335
HDPE	1,597	1,508	2,987
PET	3,207	2,448	5,475
Mixed Plastic (Rigid)	4,252	5,338	9,850
Other Plastic (Flexible)	10,623	10,675	21,140
Aluminum Cans	848	985	1,776
Steel Cans	857	1,239	2,014
Other Non-Ferrous	416	730	1,077
Other Ferrous	801	2,234	3,078
Textiles	6,135	14,645	20,589
Special	2,452	2,778	5,047
Electronics	2,631	4,043	6,509
C&D	5,227	8,580	13,543
Other/Residue	7,640	12,496	20,114
Total	**100,830**	**156,804**	**257,633**

The results presented in this Study are for Chester County solid waste. The United Stated Environmental Protection Agency (EPA) estimates the composition of waste generated, recycled and disposed in the United States using a different methodology than was used for the Chester Study. The EPA uses a materials flow methodology and in June 2015 published the *Advanced Sustainable Materials Management: 2013 Fact Sheet.*

GBB compared the results of the Chester County Study to the EPA report, comparing the material categories as accurately as possible. Table presents a side-by-side comparison of the Chester County waste composition to the EPA estimates.

Table 19 Comparison of EPA and Chester County Waste Composition Estimates

EPA Categories	United States (2013)	Chester County Combined Seasons (2015)
Food	21.1%	14.7%
Yard Trimmings	8.1%	8.4%
Paper & Paperboard	15.1%	25.8%
Plastics	17.7%	15.5%
Metals	9.1%	3.0%
Glass	5.0%	2.7%
Rubber, Leather & Textiles	11.6%	7.9%
Other and Wood	12.3%	22.0%

There are clear differences between the EPA and Chester County Study estimates. As noted previously, the methodology used by EPA differs from the Chester County Study. It is also possible that the demographics of Chester County may contribute to different compositions. For example, Chester County residents may be more conscious about food waste or have access to backyard composting resulting in less food waste disposed.

6. Conclusions

To evaluate the composition of solid waste disposed in Chester County, GBB conducted a two-season waste composition study. This Study provides information about the characteristics of the solid waste disposed in Chester County which will be helpful in understanding how well the recycling and waste diversion programs are working in Chester County.

The County is in the process of developing their updated Solid Waste Management Plan. The Study will help inform the County's Solid Waste Management Plan.

The Study was conducted over two seasons (warm and cold) to see if there was any notable seasonal variation in the disposed waste. Very little differences were noted between the two seasons with respect to areas such as yard debris. The warm season had slightly more yard debris in MSW as well as bulky waste, as would be expected. In fact, no yard waste was observed in the cold season bulky waste surveys.

The results were evaluated on an aggregate basis, and also along community types (urban, suburban and rural) and generator types (commercial and residential). This allows insight into behavioral differences between these groups.

There was very little differences between the urban, suburban and rural communities with respect to the waste composition. One item of note is that food waste disposal was highest by percentage in the urban communities, dropping from 16 percent in the urban communities to 12 percent in the rural communities, with suburban communities coming in the middle at 15 percent. This could be due to communities having

different food purchasing habits as well as rural communities having possible access to backyard composting.

There was some notable differences between commercial and residential sources of waste. Commercial sources of waste has more non-recyclable paper and more plastics (of all types) than residential sources. Also, there was slightly more old corrugated cardboard (OCC) in commercial sources of waste than residential sources. It was noted from the field staff that sometimes significant loads of OCC would be disposed in the landfills from commercial sources. Food waste was slightly greater in residential sources than commercial sources, as might be expected.

From the bulky waste surveys, a notable amount of untreated wood was observed being disposed in the landfills. These materials may be suitable for chipping and mulching. Other materials of note to target for diversion from the bulky surveys includes OCC, asphalt shingles, and plastics.

While Chester County has well established recycling program, a significant amount of recyclable materials are still present in the disposal stream. Using 2014 county-wide disposal data and the Study results, it is estimated that recyclables in the disposal stream comprise 23 percent of the disposal stream, or just over 59,000 tons of recyclables per year.

Even though paper has been shrinking in the composition of MSW across the United States over the past 20 years, it remains a significant component by weight (26 percent) of Chester County's disposed MSW. Roughly half the disposed paper, or approximately 13 percent, is comprised of non-recyclable paper and the other half is comprised of recyclable paper.

Lastly, this Study provides a benchmark upon which the County can evaluate recycling and other diversion programs in the future. By comparing this Study results against future studies, the County will continue to understand the impacts of its recycling and diversion programs.

7. Recommendations

The following recommendations are provided:

- **Solid Waste Management Plan:** The County should utilize the information in this Study during the development of the County's Solid Waste Management Plan.
- **Residential Recycling:** The County should continue to develop and implement strategies for recovery of recyclables, especially paper, from residential sources, such as improving the participation in single stream recycling programs.
- **Commercial Recycling:** The County should work with commercial establishments in particular to provide enhanced recycling education and outreach to target the recovery of recyclables including, but not limited to:
    - OCC
    - Other recyclable paper
    - Asphalt shingles
    - Plastics

- **Food Waste Diversion:** The County should evaluate residential and commercial food waste diversion opportunities throughout the County, such as backyard composting, in sink food waste disposers, and small-scale organic waste anaerobic digestion systems. This evaluation should balance the potential benefits of landfill disposal of food waste and other organics versus diversion.
- **Plastic Waste Diversion:** Plastics comprise a significant portion of the disposal stream, in the commercial, residential and bulky categories. The County should consider opportunities for the recovery and utilization of these plastics, including traditional recycling markets, fuel markets (such as Waste Management's SpecFUEL facility in Philadelphia), or plastics to fuel and/or chemical processes.
- **Wood Waste Diversion:** The County should work with the Lanchester Landfill and SECCRA Community Landfill to identify possible recovery options for clean wood, in addition to brush and tree parts.
- **Future Studies:** The County should conduct another waste characterization study in ten years to continue to evaluate the nature and composition of its solid waste and to understand the impacts of its recycling and diversion programs

The waste composition study results serve to confirm and better quantify the need for and value of the recommended program improvements and activities. As the County's population and waste generation continue to grow, these actions can help limit or reduce the amount of waste disposed, conserve valuable resources, and preserve precious disposal capacity.

Appendix A – Definitions of Waste Categories

Sort Material Categories

PAPER

Newsprint (ONP) – shall mean old newspapers that are clean and dry enough to be recycled as a commodity when separated. This shall include all newspaper inserts. This shall not include newspapers contaminated with food, feces, etc.

Office Paper – shall mean both white and colored office papers including junk mail that are clean and dry enough to be recycled as a commodity when separated. Glossy brochures, magazines, and folders shall be included.

Corrugated Cardboard & Kraft Paper (OCC) – shall mean old corrugated containers and Kraft paper sheets or bags that are clean and dry enough to be recycled.

Other Recyclable Paper

Other Non-Recyclable Paper

PLASTIC

PET (#1 Containers) – shall mean narrow necked or other containers identified by the recycling symbol with the number 1, contents shall be emptied into the Food category.

HDPE (#2 Containers – shall mean narrow necked or other containers identified by the recycling symbol with the number 2, contents shall be emptied into the Food category.

Rigid Plastic (#3-#7) – shall mean any plastic containers identified by the recycling symbol with the numbers 3, 4, 5, 6, or 7. Contents shall be emptied into the Food category.

Other Plastic – shall mean any plastic without a recycling symbol including film plastic and Styrofoam.

GLASS

Bottles and jars – shall mean any glass bottles, jars, or containers. Contents shall be emptied into the Food category.

Other glass – shall mean any glass materials that are not bottle or jars, including ceramic materials and plate glass.

METAL

Aluminum Containers- shall mean all aluminum beverage containers made from aluminum, contents shall be emptied into the Food or other appropriate category.

Steel cans – shall mean all steel food or beverage containers made from steel. Contents shall be emptied into the food or other appropriate category.

Other Ferrous – shall mean any other magnetic material including automotive parts.

Other Non-Ferrous – shall mean any other material that is not magnetic.

ORGANICS

Yard Waste Grass Clippings/Small Brush – shall mean both dry and green leaves and grass clippings, all brush, tree limbs, trimmings and shall not include lumber or other clean wood.

Food/Putrescible Waste – shall mean both uncooked foods such as potatoes and apples and cooked left over food from homes and restaurants. This shall include foodstuffs emptied from containers during the sort.

Miscellaneous Organics – paper products that are contaminated by food or other putrescible products.

OTHER

Textiles – shall mean all cloth items including apparel, linens, upholstery, shoes, belts, purses, carpet, and leather items.

Electronics – shall mean any item that is a part of a consumer electronic devices such as televisions or VCR machines.

Special Wastes– shall be containers with contents meeting the definition of hazardous, including particles, solvents, used oil, etc. Some examples include:

- Automotive fluids (motor oil, antifreeze, transmission fluid, brake fluid, fuel additives, engine degreasers, kerosene, gasoline, diesel fuel);
- Batteries (all types of batteries; including lead acid auto batteries);
- Cleaners and Chemicals (lighter fluid, nail polish remover, ammonia, rat poison, furniture polish, formaldehyde, lice shampoo, drain cleaners, arsenic, oven cleaner, drain cleaner, grease and rust removers, mold and mildew removers, detergents, fabric softeners, dyes, hair products, isopropyl alcohol, metal polish, aerosol cleaners, window cleaners, kitchen and bathroom cleaners, moth balls, bleach);
- Used cooking oil (not hardened greases);
- Lawn/garden/pool chemicals (fertilizer, pesticides, herbicides, weed killers, fungicides, chlorine, bug sprays);
- Light bulbs (fluorescent tubes, CFL, LED, Halogen);
- Paint & painting supplies (latex, oil-based, acrylic, artist paints, hobby chemicals, stains, enamels, paint thinner and stripper, turpentine, varnish, lacquer, epoxy, photography chemicals); and

- Mercury thermometers and thermostats.

C & D – shall mean construction and demolition materials, including concrete, wood, and salvaged building components.

Other - shall mean all other inorganic materials not otherwise identified, including rock, bricks, ceramics, drywall, and "fines" less than 2" in diameter.

Bulk Material Categories

WOOD

Clean dimensional lumber – Unpainted/untreated new or demolition dimensional lumber. Includes materials such as 2 x 4s, 2 x 6s, 2 x 12s, and other residual materials from framing and related construction activities. May contain nails or other trace contaminants.

Clean oriented strand board (OSB) – Engineered wood particle board formed by adding adhesives and then compressing layers of wood strands (flakes) in specific orientations.

Treated/Painted Wood – Wood that has been treated with a chemical preservative not included in any other category, such as chromated copper arsenate (CCA), also called "pressure treated wood", and wood that has had an external coating, such as paint, stain, or varnish, applied. Examples include handrails and trim. This type of wood may have a greenish tint or be perforated. Examples include some cedar shakes and shingles and most wood from playgrounds, decks, and other outdoor structures.

Painted/Stained Wood

Other – Other wood not classified in one of the categories above.

GYPSUM WALLBOARD

Gypsum Wallboard Scrap – Unpainted gypsum wallboard or interior wall covering made of a sheet of gypsum sandwiched between paper layers. Examples: This category includes used or unused, broken or whole sheets. Gypsum board may also be called sheetrock, drywall, plasterboard, gypboard, gyproc, or wallboard.

ASPHALT ROOFING SHINGLES

Asphalt – Asphalt shingles that are removed from the roofs of existing structures when the new roofs are being installed.

METALS

Ferrous – Ferrous and alloyed ferrous scrap materials originated from residential commercial, or institutional sources which are attracted to a magnet. Includes rebar, empty paint cans, HVAC ducting.

Non-Ferrous – Non-magnetic metals such as aluminum, brass, bronze, silver, lead copper, zinc, and stainless steel.

MAJOR PACKAGING WASTE

Old Corrugated Cardboard (OCC) – Paperboard containers consisting of Kraft (brown) linerboard with corrugated (fluted medium) fillings. Includes yellow and waxed corrugated boxes and Kraft paper such as bags or wrapping paper. Does not include non-corrugated paperboard products such as cereal, shoe, or gift boxes.

Plastic – Any recyclable polyethylene (high density, low density, linear low density) film plastic, plastic strapping from retail of wood, bricks, or other construction materials, plastic bottles, jars and containers; rigid plastic components; expanded foam plastics; and non-recyclable film plastics

Other PAPER – Consists of all non-corrugated and non-Kraft paper products such as newspaper, magazines, catalogs, office, computer, polycoated gable top, aseptic juice boxes, paperboard boxes, direct mail, books soiled and unsoiled tissues, paper towels, napkins, file folders, carbonless paper forms, and tissue paper.

AGGREGATES

Aggregates – Asphalt, concrete, bricks, stone, rock, rubble

CERAMICS

Ceramics – Toilets, sinks, tiles, and bath panels

OTHER WASTES

Carpet – Flooring applications consisting of various natural or synthetic fibers bonded to some type of backing material. Does not include carpet padding.

Carpet Pad – Plastic, foam, felt, and other materials used under carpet to provide insulation and padding.

Mattresses/Boxsprings – Post-consumer mattresses and boxsprings discarded through demolition or moving.

Tires – Vehicle tires. Examples include tires from trucks, automobiles, motorcycles, heavy equipment, and bicycles.

Fines – All small particles of mixed materials not distinguishable through visual survey.

Other Oversized MSW – Mixed household garbage, including trash bags containing non-C&D waste.

Appendix B– Waste Composition Data Recording Sheet

Waste Composition	
Date: **Time:**	**Landfill:** **Vehicle Number:**

Category	Sort Material	Weight (lbs)
Organics	Food	
	Leaves and Brush	
	Misc. Organics	
Paper & Cardboard	OCC	
	Office Paper	
	Newsprint	
	Other Recyclable Paper	
	Other Non-Recyclable Paper	
Glass	Bottles and Jars	
	Other Glass	
Plastic	HDPE	
	PET	
	Mixed Plastic	
	Other Plastic	
Metals	Aluminum Cans	
	Steel Cans	
	Other Non-Ferrous	
	Other Ferrous	
Other	Textiles	
	Special	
	Electronics	
	C & D	
	Other/Residue	

Appendix C – Bulk Load Visual Survey Form

Bulk Load Visual Survey Form			
Date: **Time:** **Vehicle Number:**			
CATEGORY	**MATERIAL**	**PRESENT?**	**ESTIMATED %**
Gypsum	Clean New Construction Gypsum		
Metal	Ferrous		
	Nonferrous		
Asphalt	Asphalt		
Wood	Clean Dimensional Lumber		
	Clean Oriented Strand Board (OSB)		
	Pallets and Crates		
	Plywood		
	Manufactured Wood		
	Treated Wood		
	Painted/Stained Wood		
	Other		
Ceramic	Toilet		
	Sinks		
	Other		
Packaging	OCC		
	Plastic Film		
	Strapping		
	HDPE Buckets		
	Other Paper		
	Other Plastic		
Concrete & Bricks	Asphalt		
	Concrete		
	Bricks		
	Stone, Rocks		
	Rubble		
Other Waste	Carpets		
	Carpet Pads		
	Mattress/Box Springs		
	Tires		
	Fines		
	Other MSW		
TOTAL	**ALL WASTE PRESENT IN LOAD**	**(MUST = 100%)**	

Appendix D – Waste Characterization Study Photos

WARM SEASON SORT

Initial Lanchester Tent Sorting Area

Lanchester Asphalt Shingles Bulk Load

Lanchester Staked Tent Sorting Area

Lanchester Sample Weighing Scale and Sampling Containers

Lanchester Sorting Team

Lanchester Sorting Team

Lanchester Sorting Team

Lanchester Industrial Paper Roll Tubes Bulk Load

Lanchester Pallets and Kraft Paper Bulk Load

Lanchester Resident Drop off Bulk Load

Lanchester Resident Drop off Bulk Load

Lanchester Resident Drop off Bulk Load

Lanchester Resident Drop off OCC

Lanchester Resident Drop off HDPE

Lanchester Resident Drop off Electronic Waste

SECCRA Animal Carcass Bulk Load

SECCRA Animal Carcass Bulk Load

SECCRA Herrs Factory Waste Bulk Load

SECCRA Demolition Bulk Load

SECCRA Residential Drop off Wood Waste

SECCRA Sort Team

COLD SEASON SORT

Lanchester Sorting Team

Lanchester Yard Waste Bulk Load

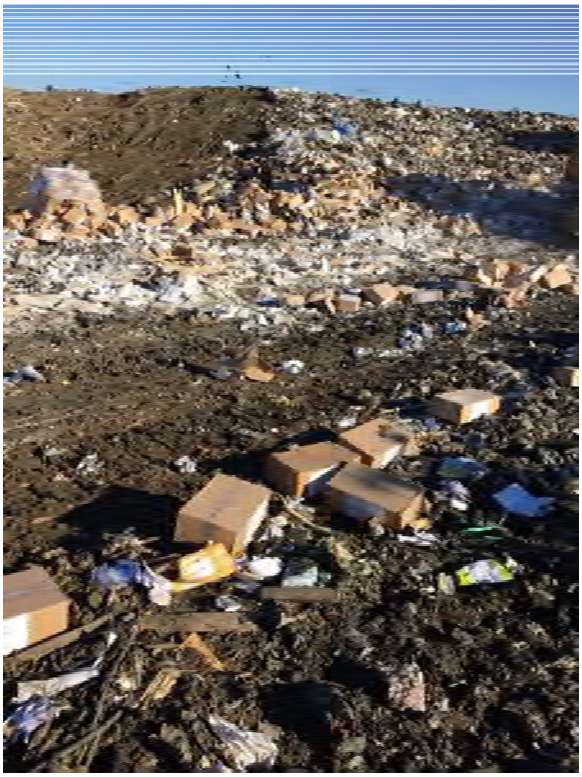
Lanchester Medical Waste Bulk Load

Lanchester Asphalt Shingles Bulk Load

Lanchester Sort Team Transporting Sample

Lanchester Coffee Waste Bulk Load

Lanchester Coffee Waste Bulk Load



Lanchester Wood Waste Bulk Load

SECCRA Sort Team Sampling Waste

SECCRA Sort Team "Weighing Out" Sample

SECCRA Field Supervisor Quality Control

SECCRA Mushroom Farm Waste Bulk Load

SECCRA Furniture Waste Bulk Load