



Developing a Pilot Program to Separate Glass from the Municipal Solid Waste / Recycling Stream in South Carolina

Prepared for:

South Carolina Department of Health and Environmental Control (DHEC)

South Carolina Department of Commerce (DoC)

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WasteZero[®]

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Background

- Glass breaks during the collection and processing of single-stream recycling, destroying the value of the glass and contaminating all other commodity streams.
- Some in SC have advocated discontinuing glass recycling, treating it as trash instead. Discontinuing glass recycling would most likely
 - Decrease the volume of recyclables collected and significantly reduce the recycling rate (due to weight)
 - Increase disposal costs
 - Send a mixed message to residents, potentially discouraging some from recycling at all
 - Be politically unpopular, and might increase the interest in a bottle bill from environmental groups
- Ideally, glass should be separated from the trash and the rest of the recycling stream to be recycled separately. This would
 - Prevent municipalities from having to pay to landfill glass
 - Prevent glass from destroying the value of other recyclables
 - Enable more glass—and its value—to be recovered
- SC DHEC and the SC Department of Commerce are interested in understanding the magnitude of the glass problem in SC, as well as potential means of piloting a solution.

Project Objectives

SC DHEC and the SC Department of Commerce approved a small initial project—for which this document is the primary deliverable—to achieve the objectives outlined below.

- 1 Understand the magnitude of the glass problem in SC
- 2 Outline a potential solution (that could be piloted) for efficiently segregating glass from the trash and single-stream recycling, and processing it separately.
- 3 Provide initial guidance as to how the results of the pilot could be evaluated

Ultimately, a pilot program will help determine if the proposed solution's benefits outweigh its costs:

Potential Benefits	Potential Costs
<ul style="list-style-type: none">• Increased glass diversion• Disposal savings• Increased value of single-stream commodities• Increased value of diverted glass	<ul style="list-style-type: none">• Cost to manage program• Cost to separate glass

Glass Recycling in SC

Scope and Impact

Development of Recycling in South Carolina

Over the past two decades, residential recycling in South Carolina has evolved from primarily drop-off convenience sites to 76 municipal curbside programs serving more than 1.1 million residents in 402,000 households. This evolution has pushed recycling rates up to nearly 30%.

Drop-Off Sites



Recycling rates were typically low
Cost of drop-off centers was included in taxes

Dual Stream Recycling



Recycling rates increased
MRFs generally did not charge tip fees
“Free” approach helped gain acceptance from local officials who had to invest in personnel & equipment

Single-Stream Recycling



Recycling increased
MRFs continued with no tip fees (for a while)
Contamination increased
Value of commodities decreased
Market fluctuations became more pronounced

Glass in Municipal Solid Waste (MSW)

SC does not have a waste characterization study, so other recent studies were used to determine the percentage of glass remaining in the waste stream. Based on this information, it can be estimated that glass represents about 3.8% of the residential discard stream, and 5% of the total MSW discard stream.

Date	Place	Reference	Glass as a % of Residential Waste	Glass as a % of Total MSW
2015	Horry County, SC	Kessler	3.70%	5%
2015	Connecticut	DSM Environmental	2.20%	2.10%
2015	US	US EPA	NA	5%
2010	Orange County, NC		3.70%	4.90%
2008	Tennessee	Tennessee State University	5.18%	5.06%
2005	Georgia	RW Beck	4.60%	3.70%
Assumptions for SC Based on Available Data:			3.8%	5%

Glass in Recycling

Based on an estimated average tip cost of \$38 per ton in 2015, comingled glass diverted through single-stream recycling (residential & commercial) provided disposal savings of \$576,522. All glass recycling yielded disposal savings of \$815,480.

	Residential Recycling		Residential + Commercial Recycling	
	Tons	Percentage of Recycling	Tons	Percentage of Recycling
*Comingled Glass	9,620	2%	15,172	1.4%
Glass - Drop Off	5,879	1.3%	6,289	0.6%
Other Comingled	97,265	21%	153,402	13.9%
Other Drop Off	356,555	76%	926,327	84.1%
Total Glass Recycled	15,498	3.3%	21,460	1.9%
Total Material Recycled	469,318		1,101,190	

Source: SC DHEC 2015 Annual Report

*Pratt and Sonoco estimates

Glass That is Discarded

SC homes and businesses spend nearly \$6 million annually to dispose of about 152,000 tons of glass. Of this total, residential tax dollars cover nearly \$2 million annually and businesses cover nearly \$4 million annually.

	*Residential	**Commercial	Total MSW
Glass Generated (tons)	66,911	107,469	174,380
Glass Recycled (tons)	15,498	5,962	21,460
Glass Discarded (tons)	51,412	101,507	152,919
Cost to Landfill	\$1,953,674	\$3,857,263	\$5,810,937

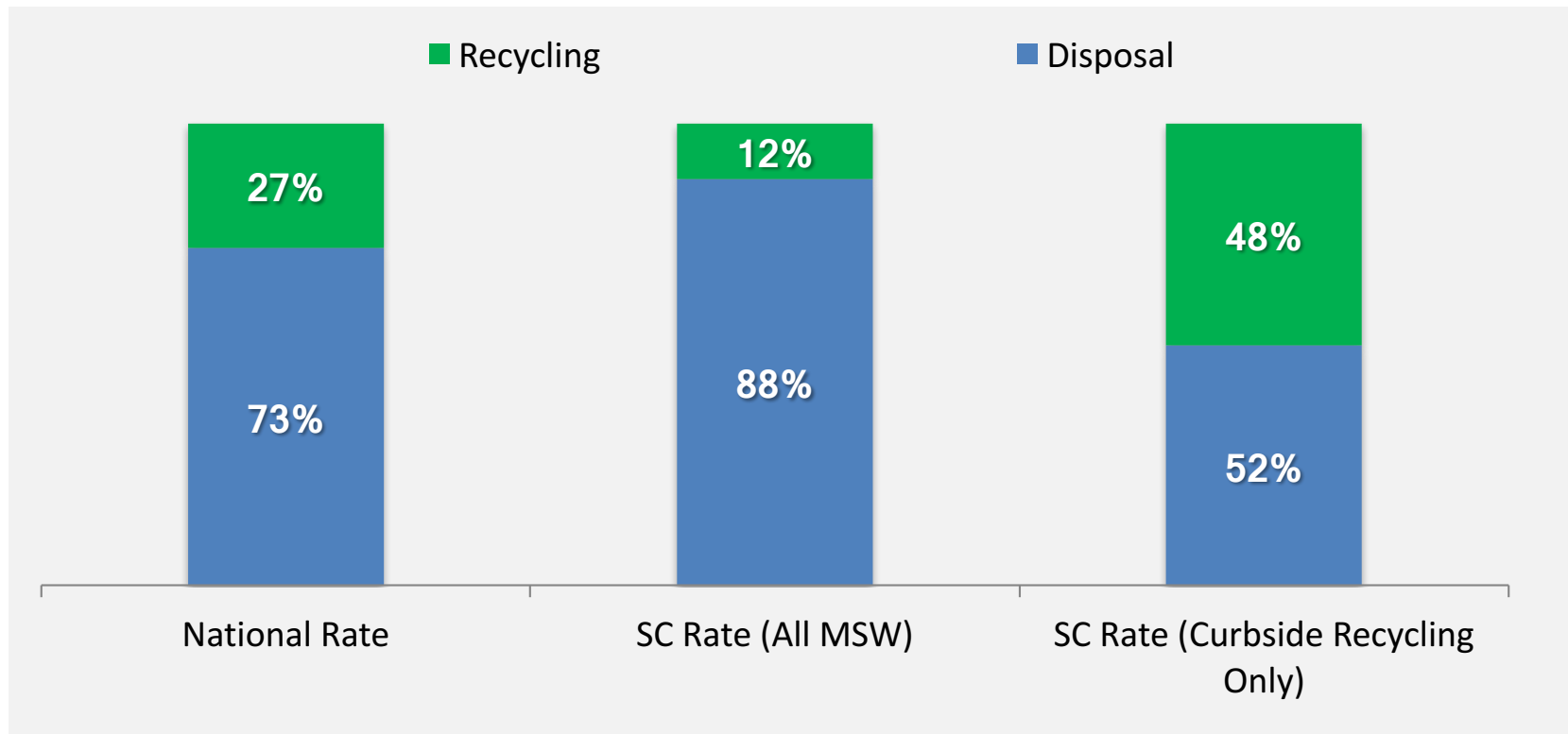
Assumptions:

*Residential Glass is 3.8% of residential waste stream

** Commercial glass disposed is 5% of commercial waste stream

Glass Capture Rate

According to the US Environmental Protection Agency (EPA), the national glass recycling rate is 27%. SC trails the national average, at 12% overall. In SC, approximately 402,000 households (1.1 million residents) in 76 municipalities have access to curbside recycling through a municipal curbside collection program. The 2015 glass recycling rate for these homes was 48%.



Source: SC homes with access to curbside participation was based on the effective population receiving service in the 76 communities that offer municipal curbside recycling.

Glass Recycling Infrastructure in SC and the Region

1. Municipalities:
 - 76 municipalities offer curbside collection of glass
 - A few commercial recycling collectors—such as Fisher or Tomato Palms—collect single-stream materials from residences in unincorporated areas, as well as businesses. This material is recorded as commercial recycling.
2. Four major Materials Recovery Facilities (MRFs):
 - Pratt (Greenville area)
 - Horry County
 - North Augusta
 - Sonoco (Columbia area)
3. Several “mini-MRFs” (smaller, primarily sort materials by hand)
 - Aiken
 - Georgetown
 - Greenwood
4. Regional Remanufacturers:
 - Strategic (Atlanta, GA and Wilson, NC)
 - Owens Corning

The Value & Cost of Glass

The value of glass varies considerably based its cleanliness, color, whether it's sorted or mixed, and other market factors. In addition, the value of single-stream commodities varies, in part, based on glass content.

	*(Cost) or Revenue to Cities for Single-Stream Recyclables		**Glass Mfr. (Fee) or Payment to MRFs for Glass	
	With Glass	Without Glass	Mixed Glass	Clean Sorted Glass
Per Ton Rate, SC, 2015 & 2016	(\$14) to \$0	\$0 to \$10	(\$22) to (\$17)	\$13- \$22.50

Sources:

- Sonoco and Pratt
 - **2015-16 Secondary Markets Database
 - ***Benefits of Increased Recycling Rates in South Carolina, University of South Carolina 2016
- **Single stream market values are not just effected by glass:*****Over the past 10 years, the single-stream recycling markets have seen highs and lows. During the high in 2011, MRFs in SC paid municipalities \$23 per ton. At the low in 2016, they charged municipalities \$14 per ton. These fluctuation are due to demand, quality / contamination level, and other factors.
 - **Proximity to glass manufacturer effects net benefit for glass:** Because glass is heavy, even if a MRF is paid \$13 per ton it might cost \$13 to ship material out of state
 - **Municipal programs help demand for glass:** In areas of the country where regulations allow, the glass is used for drainage, roads, or landscaping

Single-stream commodities are more valuable without glass:

Getting glass out of all residential co-mingled materials (at current volumes, see p.6) could transform a potential cost of \$1.4 million for cities and towns into a gain of about \$1 million. That's a swing of \$2.4 million.

The Economic Impact of All Glass Currently Recycled in SC

South Carolina's 2015 glass diversion represents 950 jobs, more than \$47 million in labor income, and an economic output of more than \$228 million. In 2014 Strategic Materials bought Reflective and closed the SC glass manufacturing facility, so not all of this impact is realized in South Carolina, but it is realized regionally.

	Tonnage	Annual Employment	Annual Labor Income	Annual Economic Output
Residential Glass Recycled	15,498	686	\$34,039,225	\$164,716,929
Commercial Glass Recycled	5,962	264	\$13,094,789	\$63,366,115
Total Glass Recycled	21,460	950	\$47,134,014	\$228,083,043

For each ton of glass diverted, there is an increase in annual economic output of \$10,628.

Source:
Benefits of Increased Recycling Rates in South Carolina, University of South Carolina, 2016

Prepared by WasteZero, Inc., 2016

The Economic Impact of Comingled Glass Currently Recycled in SC

When focusing on comingled glass (which would be the subject of any diversion program), the impact is still quite high.

	Tons Recycled	Annual Employment	Annual Labor Income	Annual Economic Output
Residential Comingled Glass Recycled	9,620	426	\$21,122,464	\$102,212,296
Commercial Comingled Glass Recycled	5,552	246	\$12,194,139	\$59,007,841
Total Comingled Glass Recycled	15,172	672	\$33,316,603	\$161,220,137

Average Annual Economic Impact per HH with Comingled Glass Recycling:

0.024 tons	.001 jobs	\$52.52 labor income	\$254.14 Economic Output
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For example, glass recycling in a city the size of Columbia (45,000 households with recycling service) would generate \$2.4 million in labor income and \$11.5 million in economic impact.

Increasing Diversion = Enhanced Economic Impact

Using the figures provided, increasing the volume of glass diversion in households and businesses that currently have single-stream recycling service would provide the enhanced economic impacts below.

	Status Quo	10% increase	25% increase	50% increase
Comingled Glass Recycled (Tons)	15,172	16,689	18,965	22,758
Jobs Created	672	739	840	1008
Annual Labor Income	\$33.3 million	\$36.6 million	\$41.6 million	\$50 million
Annual Economic Impact	\$161.2 million	\$177.3 million	\$201.5 million	\$242.3 million

The Problem and Potential Solution

The Problem

If SC is to meet its goal of 40% recycling, it's important to continue recycling glass. However, single-stream collection of glass is challenging for the reasons outlined in the introduction to this document.

- There is a cost to handling the glass collected from single-stream recycling. Over the past year a few approaches have been taken to dealing with glass:
 - Pratt (MRF operator) has chosen to discontinue accepting all glass from municipal and commercial partners.
 - Sonoco (MRF operator) has decided to continue accepting glass, but they are negotiating a profit/cost share into their municipal contracts: When markets are good the municipality and Sonoco share in the profit; When the markets are down the municipalities will pay a fee for recycling. Glass has been the primary driver.
 - Horry County is not privately owned, so it faces less financial pressure. It has purchased additional equipment to clean the material enough to produce a landscaping end-product that can be sold locally to offset some costs.
 - North Augusta is struggling to improve its system and is evaluating all aspects, including glass.
- Landfilling is relatively inexpensive, and some have asked if simply discarding glass would be economically and environmentally preferable.
- The state has spent resources over the past decade to educate residents on the value of recycling. It's important to maintain a consistent message for residents. Discontinuing glass recycling would likely:
 - Decrease the volume of recyclables collected and significantly reduce the recycling rate (due to weight)
 - Increase municipal disposal costs
 - Send a confusing mixed message to residents, potentially discouraging some from recycling at all
 - Be politically unpopular, and might increase the interest in a bottle bill from environmental groups

The Choices

There are 4 potential paths for MRFs in states like SC with low tip fees, landfills, and limited local access to glass end processors.

	Charge Extra Fees	Discontinue Glass	Bottle Bill	Glass Co-Collection
Description	Continue accepting glass in single stream, but negotiate fees with municipalities to cover glass and other commodities contaminated with glass.	Municipalities would simply pay to landfill glass	Implement a bottle deposit law and system like 10 other states currently have.	Have residents source-separate glass into official “glass bags”, then deposit the filled bags into their single-stream recycling containers. Glass is separated later at the MRF for processing.
Pros	<ul style="list-style-type: none"> Preserves glass recycling 	<ul style="list-style-type: none"> Easy Cleaner stream might provide some revenue 	<ul style="list-style-type: none"> Would provide cleaner, higher-quality glass Would increase volume 	<ul style="list-style-type: none"> Ends the core problem of glass contamination Preserves the value of all recyclables, including glass Enables realization of economic benefits Helps meet recycling goals
Cons	<ul style="list-style-type: none"> ‘BANDAID’ Does not address the core problem About \$6 per household Costly to municipalities Value of other commodities is still reduced Does not address the wear on equipment 	<ul style="list-style-type: none"> Failure to meet recycling goals Costly to landfill glass about \$1 per household Negative impact on Jobs and annual labor income about \$52 per household Negative economic impact about \$254 per household Failure to realize any value from glass Politically unpopular 	<ul style="list-style-type: none"> Politically difficult Complicated 	<p>The question is whether the benefits outweigh the costs.</p>

The Opportunity: Glass Recycling Bag Co-Collection Pilot

With the proposed solution, residents would place glass bottles into specially designed “glass recycling bags” and deposit the full bags in their single-stream recycling carts for collection.

How It Would Work:

- Residents place glass bottles, etc. into specially designed, official “glass recycling bags”
 - Heavy duty LLDPE plastic
 - Special color and printed with instructions
 - Drawstring to allow air to escape during compaction
- Residents place full bags into their single-stream recycling carts
- All material is collected at once (recycling, with glass in bags)
- Glass bags are separated at the MRF
- Glass is debagged and processed separately

Potential Benefits:

- Prevents municipalities from having to pay to landfill glass
- Provides a better single-stream revenue share
- Prevent glass from destroying the value of other recyclables
- Provide a better quality glass end-product for use in manufacturing
- Enables a glass manufacture to locate in South Carolina, grow glass industry jobs, and increase economic benefit within the state



Co-Collection: A Key Component

In the proposed system, loose single-stream recyclables and bagged glass would go into the same truck. Materials are later separated at the MRF. This is a type of co-collection. As a system, co-collection is well-proven.



With Co-Collection:

- Trash, recycling, organics, glass, and/or other materials can be collected in the same truck on one route.
- Residents put materials in color-coded bags, which are separated later at the processor.
- Automated or manual collection works well.

Co-Collection Overview

Far more complex systems than the one proposed operate throughout Europe and elsewhere.

1



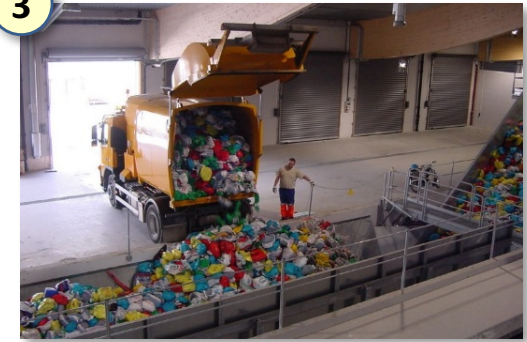
In some co-collection systems, residents separate numerous material types into color-coded bags.

2



All bagged material goes into one bin, & then is collected by one truck on one collection route

3



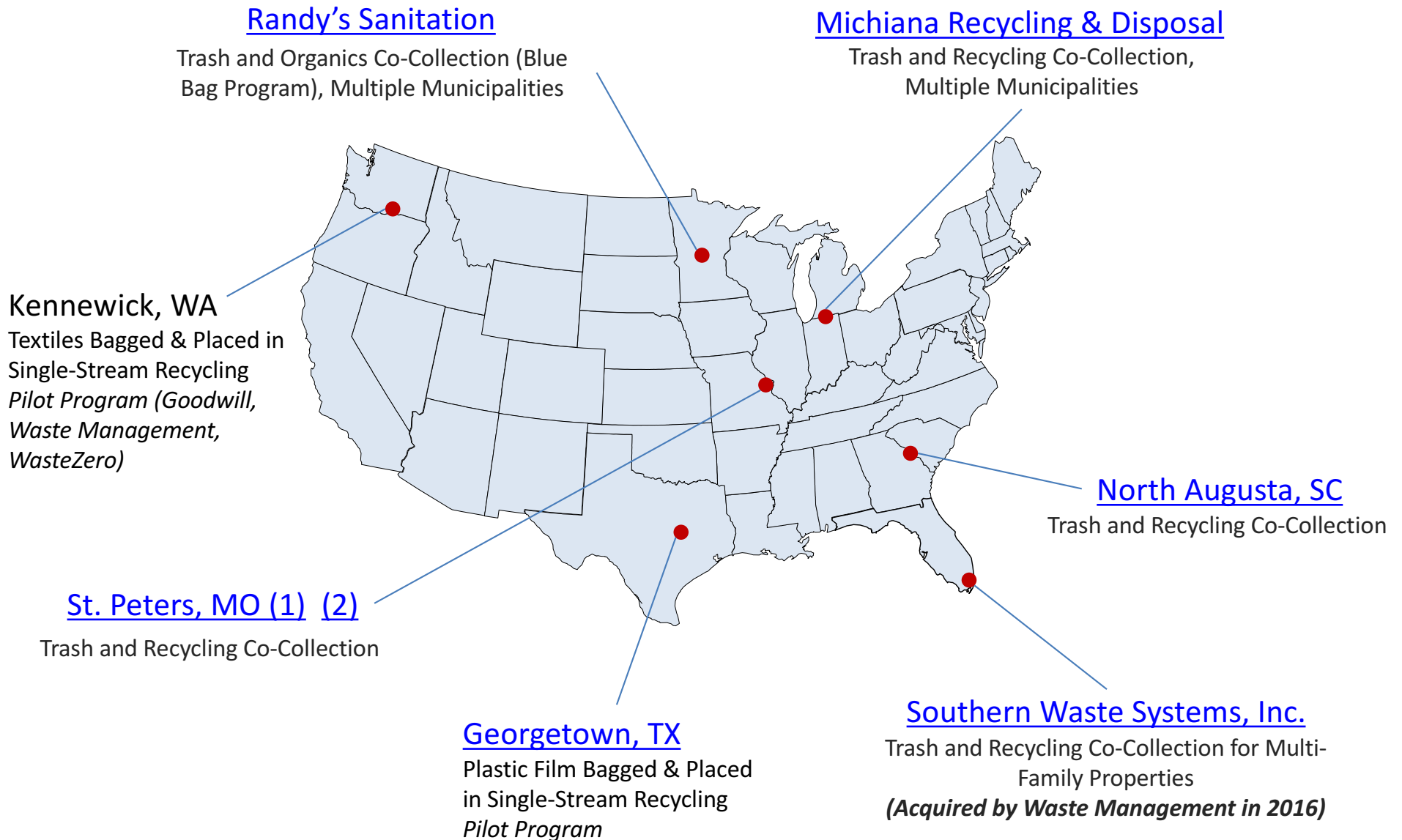
Materials are separated at transfer station. Automated optical sort systems are available to sort bags.

In some systems, materials are separated manually.

The SC glass bag pilot would use manual sorting.

Co-collection is widespread in Europe, especially Scandinavia. It is used in 36 municipalities in Sweden and 58 in Norway, covering a total of 2.2 million residents. It is also used in some US municipalities.

Selected Examples of US Co-Collection Programs



The Pilot and How It Would Work

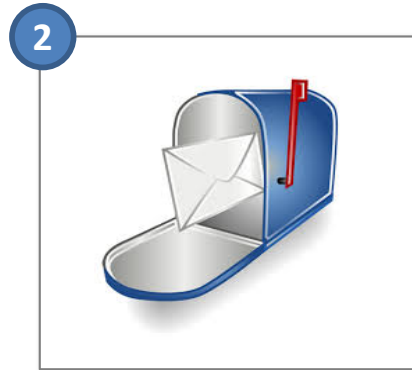
The Proposed Glass Co-Collection Pilot – How It Would Work



3,000 homes will be selected and asked to use Official Glass Recycling bags for a 6-month period:

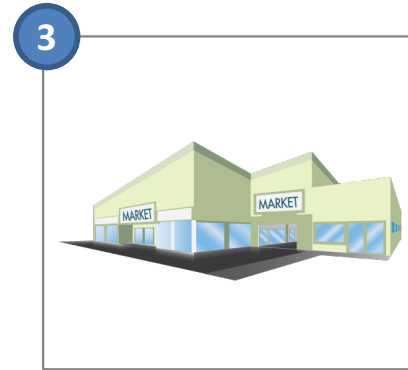
- LLDPE
- 8-gallon
- 2 mil gauge
- Drawstring
- Printed
- Special color

Participants will be informed via media outreach, mailings, a website, and public meetings.



Each participating household will receive a pre-launch mailing describing the program and providing free bag(s):

- 50% of households will receive 1 free bag
- 50% of households will receive 4 free bags



Residents may purchase additional bags at local supermarkets (8 bags for \$4.00).



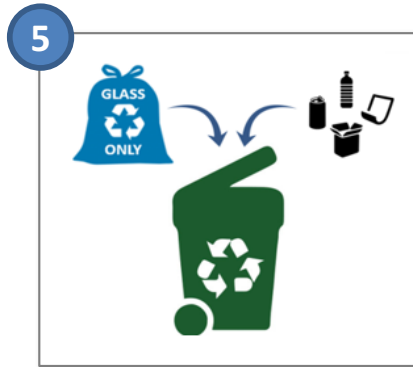
Residents place empty glass containers in official glass bags.

Other recyclables go into their normal container.

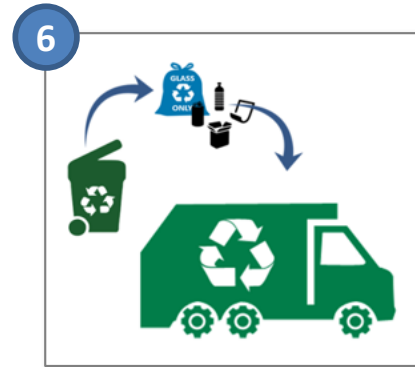
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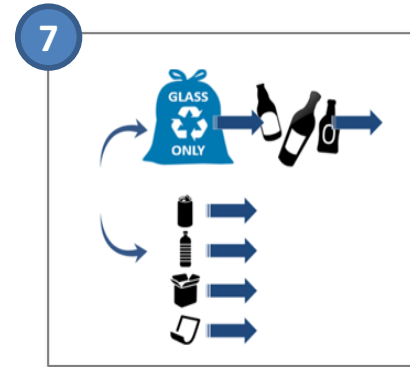
How It Would Work (Continued)



5 Full glass bags go into cart with other recyclables for collection.



6 All material is collected together at the same time.



7 Glass bags are pulled from recyclables at the MRF. Glass is debagged & shipped to the processor.



8 Funds from the Glass bag are remitted to the glass project.

- Based on the est. percentage of glass in the single stream mix, and the # of participating households, 1.3 tons (max.) of glass will be collected per week.
- Based on an est. 10 lbs./bag, there will be 275 bags per day/34 per hour (max.).
- At the MRF, one person will be needed for 8 hours, one day per week, to separate the bags.
- All glass bags would be opened by hand, inspected, and information on weight, quality and contamination level will be recorded. Each load of glass will also be tracked based on neighborhood other materials from the same load will also be evaluated and recorded.
- Glass would be stored in a roll-off container until ready for shipment to the end processor.

Other materials are separated & processed as usual.

Process will be done by hand for the pilot but could be automated if concept is scaled.

Program will yield approximately \$74 per ton to cover shipping and processing costs.

WasteZero can manage key aspects of this program in a turn-key fashion, though close coordination and support is required from the participating MRF.

Flow of Funds in the Program (Annualized Revenue)

	Pilot of 3,000 Homes Based on current curbside glass recycling rate	Statewide Based on current 402,000 HH with curbside collection	Statewide Based on current commercial & residential comingled collection
Total Glass Tonnage Recycled	74	9,620	15,172
Est. Weight per Bag (lbs.)	10	10	10
Estimated No. of Bags used	14,800	1,924,000	3,034,400
Revenue per Ton	\$74	\$74	\$74
Est. Bag Revenue (less bag & distr. costs)	\$5,476	\$711,880	\$1,122,728

Pilot – Stakeholders’ Needs

The purpose of this pilot is to look at a possible long term solution that meets the needs of all South Carolina stakeholders:

Stakeholder	Needs
Residents	Have a convenient, affordable way to recycle glass
Municipalities	Divert glass from landfill; Maximize revenue from commodity recycling
MRFs	Operate at a profit; Maintain the integrity and value of other commodity materials.
End Processors	Operate at a profit; Obtain consistently clean material (ideally from local sources)
SC Recycling Industry	Increase local supply of all commodity materials; Attract new recycling business to SC
DHEC	Increase residential diversion of all materials
Glass Manufacturers	Increase glass recycling in a cost-effective way; Avoid bottle bill legislation

Pilot – Objectives

1

Determine Feasibility

2

Confirm Funding
Mechanism

3

Determine Outreach
Approach

4

Evaluate Scalability

The pilot will provide the metrics and information necessary to determine the feasibility of source-separating glass and co-collection on a larger scale.

- Assess viability of co-collecting glass with loose single stream material (Do the bags stay intact during collection?)
- Evaluate process of separating special “glass bags” from the single stream mix at the start line (How many bags pass through per minute? Should this process be automated or done bay hand? How much labor / other costs are required? How much space is needed to collect, stage and ship glass?)
- Determine where the glass bags should optimally be opened (at the MRF vs. at the glass manufacturer) and the cost of doing so.
- Understand the impact on commodity value:
 - Glass: What is the value/cost of the new glass product? Is the bagged material clean and free of contaminants or are residents misusing the bags?
 - Other Commodities: Has the value of the other commodities increased because much of the glass has been removed from the single stream mix? Are residents following the rules?
- Determine the level of participation needed to make a co-collection process worth scaling.
- Determine the program’s impact on other / overall recycling levels.

Pilot – Objectives

1

Determine Feasibility

2

Confirm Funding
Mechanism

3

Determine Outreach
Approach

4

Evaluate Scalability

Summary of Pilot Metrics to be Measured:

- Volume / amount of glass recovered from pilot neighborhoods before and during pilot (tonnage & average per capita)
- Quality of glass recovered before and during pilot
- Number of bags sold/used and average weight of glass per bag
- Level of glass contamination in single-stream recyclables before and during pilot
- Cost to manually separate glass bags from single-stream recycling (compare to estimated cost of automated separation at scale)
- Cost to debug glass
- Overall recycling rate of pilot neighborhoods before and during pilot
- Difference in value of single-stream commodities before and during pilot (to the extent that this can be determined, given market dynamics)
- Difference in value of glass before and during pilot (again, to the extent this can be determined)

Pilot – Objectives

1
Determine Feasibility

2
Confirm Funding Mechanism

3
Determine Outreach Approach

4
Evaluate Scalability

A glass recycling program will have costs associated with it (as well as financial benefits). The pilot will help determine the ratio of costs to benefits, and provide guidance regarding how to price the bags in a financially sustainable manner that is acceptable to consumers.

- Determine the optimal price point that will—when combined with the program’s financial benefits—cover the program’s costs:
 - Collection / enforcement
 - Separation of glass bags from single-stream recycling
 - Debagging of glass
 - Shipping
 - End processing (cost or potential rebate?)
- Determine the average weight of glass bags returned and the average number of bags used per ton of material (enables accurate revenue projections)
- Evaluate what price point will get maximum participation from consumers
- Suggest price for scale-up.
- Evaluate questions like: Could low income families receive vouchers?

Pilot – Objectives

1

Determine Feasibility

2

Confirm Funding
Mechanism

3

Determine Outreach
Approach

4

Evaluate Scalability

Optimize the resident education program:

- Run a pilot-level communication plan that will provide valuable insights for a possible full-scale program:
 - Lead public meeting(s) for participating households.
 - Develop a web site to explain the program and provide information for participants.
 - Create supporting educational materials.
 - Provide a launch mailing to pilot households and determine if a mailing with 4 free bags results in greater participation than a mailing with 1 free bag.
 - Provide media relations support at the state level and in the pilot community.
 - Gather feedback and questions from residents to improve on the initial messaging.
 - Determine if a broader glass recycling education program could also be leveraged to support other recycling / diversion goals.

Pilot – Objectives



Determine what would be needed to scale the glass recycling bag project at each of SC's MRF locations:

- Estimate expected volume at each MRF location based on population.
- Determine if commercial glass could be collected in a similar fashion from multifamily apartments, restaurants, or others that also utilize curbside recycling.
- Determine if the bags should continue to be separated by hand or if the volume would justify an automated process (which is available with current optical sort technology that selects and removed targeted bags based on color).
- Estimate potential scale-up costs to MRFs or processors.
- Estimate the educational requirements and costs

Conclusion

- Discontinuing glass recycling will
 - Cost cities and towns more
 - Fill up landfills faster
 - Reduce the recycling rate
 - Fail to capture the value of glass
- Simply charging extra fees to deal with glass in a status quo system will
 - Cost cities and towns more
 - Fail to capture maximum value of all recyclable commodities
- A Bottle Bill would be expensive, complicated, and politically controversial.
- A source-separated “glass bag” system with co-collection may be the solution, but we must pilot it to know for sure:
 - Quantify the benefits
 - Understand the costs
 - Measure the impact

Next Steps

- Gather your input and answer questions.
- Determine whether to proceed with the proposed pilot project.
- Determine approval and vendor selection process.
- Select vendor to manage the project.
- Secure approval, execute a Scope of Work agreement, and kick off the project.
- Select partner MRF and develop measurement benchmarks.
- Select partner municipality and determine routes and demographics for the pilot.