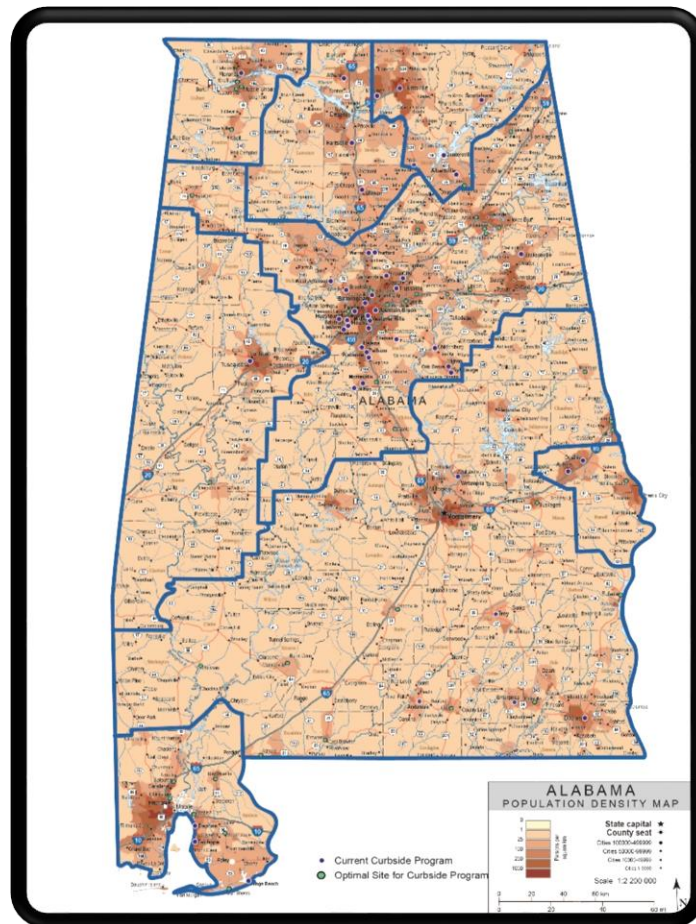


A Plan for Boosting Residential Material Recovery and Recycling in Alabama

Prepared for SERDC and the Alabama Recycling Partnership

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RME Associates, Weaverville, North Carolina

Table of Contents

Executive Summary.....	7
Recommended Best Practices for Alabama Recycling	8
The Value of Material Discarded and the Price Paid to Discard It.....	9
Break down the MSW into Residential and Commercial Streams	9
Define the Recyclable Portion of Residential MSW.....	10
The Price of Disposal.....	14
The Value of Discarded Recyclable Materials	14
The Economic Impact of Recycling in Alabama.....	16
Section 2: State of Residential Recycling in Alabama	19
Recycling Systems used in Alabama.....	19
Curbside Recycling.....	20
Drop-off Recycling	23
Materials Processing in Alabama	24
Evaluating the Adequacy of Recyclables Processing Infrastructure	26
Grant Funding to Processors	27
Optimizing Recyclables Processing in Alabama.....	28
Recycling Markets	29
Paper.....	29
Plastics.....	29
Metals	30
Glass	31
Section 3: Best Practices Recommendations for Expanding and Improving Recycling in Alabama.....	33
Best Practice: “Hub and Spoke” System	33
Definition of Hub and Spoke.....	33
Other State’s Experience	33
Hub and Spoke for Alabama	35
Material Generation and Required Hub Capacity	35
Organization of Hubs and Spokes for Alabama.....	37
Best Practice: Cart-Based Single-Stream Curbside Recycling.....	51
Best Practice: Comprehensive Drop-off Recycling.....	54
Best Practice: Common Suite of Materials	58
Best Practice: Standardized Education and Outreach	62

Best Practice: Improved Data Gathering.....	65
Best Practice: Tools for Higher Performance.....	67
Universal Recycling Access.....	67
Disposal Restrictions.....	68
Variable Rate Solid Waste Pricing.....	69
Provision of Recycling Service through Hauler Permitting/Licensing.....	70
Best Practice: Restructure Grant Program.....	74
Summary of Grants Program.....	74
Grants Survey	76
APPENDIX	i
Appendix Table 1: Alabama Curbside Cities, Existing and Planned.....	2
Appendix Map 1: Alabama Proposed Hub and Spoke Regions	6
Appendix Map 2: Region 1, Florence Hub.....	7
Appendix Map 3: Region 2, Huntsville Hub	8
Appendix Map 4: Region 3, Decatur Hub	9
Appendix Map 5: Region 4, Birmingham Hub.....	10
Appendix Map 6: Region 5, Tuscaloosa Hub.....	11
Appendix Map 7: Region 6, Montgomery Hub.....	12
Appendix Map 8: Region 7, Mobile Hub.....	13
Appendix Map 9: Region 8, Columbus GA Hub.....	14
Selected Excerpts Addressing Waste Composition Methodology.....	15
The Economic Impact of the Recycling Industry in Alabama	24

Sponsors of the project:

The Southeast Recycling Development Council joined with the Alabama Department of Environmental Management to form the Alabama Recycling Partnership to make this report possible. SERDC extends its appreciation to these companies for their support of the project.



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Executive Summary

In 2015, the State of Alabama requested that the Southeast Recycling Development Council (SERDC) evaluate the adequacy of Alabama's material recovery and recycling system, and provide recommendations to improve it. The State also requested the participation of additional stakeholders in this study. The result was the Alabama Recycling Partnership, comprised of the Alabama Department of Environmental Management (ADEM), along with the cities of Daphne, Decatur, Florence, Guntersville, Troy and Tuscaloosa. Financial support for the report was also provided by the Proctor and Gamble Corporation (P&G), KW Plastics, the Carton Council, and International Paper, as well as SERDC and its membership.

This report found that the recycling industry is an economic engine for Alabama. Modeling done for the state by Dr. Frank Hefner, a professor of Economics at the College of Charleston and an expert in determining the economic value of commercial and industrial activity, revealed that the current level of recycling in Alabama generates a significant economic impact. His work, detailed in the appendix, determined that recycling in Alabama causes a direct impact of 32,400 jobs. As the people employed in those jobs spend money induced jobs are supported creating a total of 84,412 jobs. This generates economic activity estimated at \$19.4 billion.

The potential for greater economic benefit through expanded recovery of recyclables in Alabama is large enough to be pursued. The combined value of disposed materials, plus the cost in landfill tipping fees for disposal, is estimated at almost \$117 million annually. Using Dr. Hefner's model, the estimated 711,436 tons of recyclables discarded in 2015 could represent almost 1,200 new direct jobs and would induce another 1,920 jobs for the state of Alabama.

This report found that Alabama is nearing its statutory waste reduction goal of 25%, with a reported rate of 16.36% and an estimated achievable rate of 27.71% in 2015. However, material recovery and recycling is not reaching its potential in the state, with only 25% of the population having access to household curbside recycling. Markets for all materials are abundant either in the state or surrounding southeastern states, but Alabama's processing capacity is insufficient to manage growth in recovery. Few large privately-operated material recovery facilities operate in Alabama, leaving local governments to manage small processing centers in a fragmented system.

This report recommends eight best practices that could transform the state into an engine of material recovery. The key best practice recommendation is that the state establish a regional recovery system based on a few large material recovery facilities that aggregate materials from multiple community recycling programs via a connected network of spokes along transportation corridors. The other seven best practices support this hub and spoke system by enabling maximum material recovery.

Recommended Best Practices for Alabama Recycling

The following best practices are recommended for the State of Alabama to achieve the goal of maximum recovery of residential materials for recycling.

1. **Optimize the collection, transportation, processing and marketing of recyclables along a system of “hubs” and “spokes”, which will enable a standard system of recycling practices to reach the entire population by transferring unprocessed or semi-processed recyclables from the rural areas and smaller towns to the larger cities where final processing and marketing can be done.**
2. Encourage and incentivize local communities of over 5,000 population to provide cart-based single stream recycling for all commonly recycled materials except glass containers, as well as encourage and incentivize curbside communities to promote drop-off recycling centers for glass containers.
3. Encourage and incentivize curbside communities to provide drop-off recycling access for their multi-family populations, and rural communities for their entire populations. Drop-off centers should establish single-stream collection for the same suite of materials as curbside programs, should accept glass containers in separate receptacles, and should provide all residents with recycling opportunities for other materials such as appliances, scrap metals, lead-acid and rechargeable batteries, used motor oil, oil filters and tires.
4. Encourage and incentivize local governments to adopt a common suite of materials in their recycling program. The state should also develop a toolkit of consistent material descriptions and terms for these materials, using available industry sources, and disseminate these for use in local recycling promotional and educational materials.
5. Develop a standardized recycling education and outreach program that establishes a theme and a “brand” for recycling in Alabama, and then provide specific tools to communities to enable them to adopt the brand, and adapt the theme to their own situations.
6. Improve the statewide data reporting system and ensure that it covers all entities that manage materials, including collectors and markets. The state should convene relevant stakeholders in a structured design process enabling them to have input into the system to ensure cooperation and understanding.
7. Adopt certain programmatic strategies in support of the regional hub and spoke recycling system recommended in this report, including:
 - Universal Access to Recycling,
 - Disposal limitations for certain post-consumer packaging materials,
 - Variable rate solid waste pricing, also known as “Pay as you Throw,”
 - Provision of recycling through hauler licensing.
8. Restructure its recycling grant program to support all of the facets of this report’s recommended new recycling system by being strategic in awarding grants to create a statewide recycling system; targeting grant funds to the four foundational building blocks of large-scale material recovery; and clearly outlining reporting requirements along with grant awards.

Section 1: The Importance of Recycling for the State of Alabama

The Value of Material Discarded and the Price Paid to Discard It

Alabama residents discard approximately 91% of the municipal solid waste (MSW) they generate, and recycle only about 9%, according to a 2014 multi-state survey by Columbia University¹. Municipal solid waste is defined by the United States Environmental Protection Agency (EPA) as waste originating from homes, schools, hospitals and businesses that consists of commonly used items discarded at the end of their useful life, including product packaging, paper goods such as office paper and newspaper, clothing, bulky items such as furniture and appliances, food scraps, appliances, paint and batteries². This definition excludes bio-solids, hazardous wastes, construction and demolition (C&D) wastes, industrial wastes, and agricultural wastes.

From 2012 through 2015, Alabama's discards of MSW remained consistent, from approximately 4,730,330 tons per year in 2012 to approximately 4,600,000 tons per year in 2015.³ A significant portion of this discarded material could be recycled instead of landfilled. The potential recyclables have economic value as commodities, which is forfeited when they are discarded, and as discards represent a real economic loss to the state in landfill tipping fees paid to disposal facilities.

Break down the MSW into Residential and Commercial Streams

The scope of this report is to make specific recommendations to the State of Alabama on best practices to boost residential household recycling; therefore, only the residential portion of Alabama's MSW will be examined for its value. According to the US EPA, in 2010 approximately 55 percent of MSW originated from households.⁴ While this is the last year that EPA published this estimate, it is used here because no data was found indicating economic changes that would significantly alter this balance occurred in Alabama since 2010.

The residential portion of Alabama's MSW thus consists of approximately 2.53 million tons.

¹ Shin, 2014. "Generation and Disposal of Municipal Solid Waste (MSW) in the United States – A National Survey", Columbia University Earth Engineering Center

² US EPA, "Advancing Sustainable Materials Management, Facts and Figures 2013". https://www.epa.gov/sites/production/files/2015-09/documents/2013_advncng_smm_rpt.pdf

³; Shin 2014; and Eric Sanderson, Email correspondence

⁴ US EPA, https://archive.epa.gov/epawaste/nonhaz/municipal/web/pdf/msw_2010_factsheet.pdf

Define the Recyclable Portion of Residential MSW

In order to calculate the recyclable portion of residential MSW, data on the composition of disposed waste must be known, especially the percentage of aluminum cans, paper, and plastics remaining in the waste stream after recycling. Because actual physical waste sorting was not part of this study's scope, reputable waste composition studies were examined, and the data applied to Alabama's discarded waste.

The characterization studies used here were done between 2013 and 2015 by the State of Illinois⁵, Montgomery County, Maryland⁶ and Prince William County, Virginia⁷. In choosing these studies, there were a number of parameters considered. Each of these selected studies carried out their analysis between 2013 and 2015, which makes certain the data reflected the current waste stream composition. All of these identified reports are from states that do not have deposits on beverage containers (non-deposit states), which is consistent for Alabama, a state without a deposit system in place. Additionally, these studies were found to be robust and thorough in their analysis. Hundreds of samples were extracted at different times in the year from the generating sectors of residential and commercial as well as urban and rural settings.

The methodology used by the waste composition studies involved physical sorting of representative samples of the residential waste streams in the selected communities into recognized, marketable commodity groups. Every report had slightly different ways of listing the categories. As a result, categories and subcategories were compared and reconfigured where necessary to create consistency among the columns of compiled percentages for this analysis. From the greater list of all materials (recyclable and non-recyclable) found in the waste stream, SERDC identified a list of the target recyclables that are the more commonly accepted items in a municipal recycling program (Table 1).

⁵ Illinois Commodity/Waste Generation and Characterization Study Update. (2015). <http://www.illinois.gov/dceo/whyillinois/KeyIndustries/Energy/Recycling/Documents/2015WasteCharacterizationUpdateFINAL.pdf>

⁶ Montgomery County Waste Characterization Study Summary of Results. (2013). <https://www.montgomerycountymd.gov/sws/resources/files/studies/waste-composition-study-130726.pdf>

⁷ Prince William County Virginia Waste Characterization Study Summary of 2013-2014 Results. (2014). <http://gbbinc.com/gbbwp2013/wp-content/uploads/2013/10/PWC-Waste-Characterization-Final-Report.pdf>

TABLE 1: COMMONLY ACCEPTED RECYCLABLES

Paper	Plastic	Glass	Metal
Newspaper	#1 PET Bottles/Jars, Other PET Containers	Recyclable Glass Bottles & Jars	Aluminum Beverage Containers
Uncoated OCC/Kraft	#2 HDPE Bottles/Jars (Clear, Color), Other HDPE Containers		Ferrous Containers (Tin Cans)
Aseptic / Poly- coated cartons	#3-#7 Bottles		
Mixed Paper -High Grade Office Paper, Boxboard, Paperboard, Magazines, Phone Books, Other Recyclable Paper	Other Plastics – Recyclable containers and tubs, Other rigid plastics		

After confirming the list of recyclables from the broader categories, the next step involved extracting the percentages of these recyclable materials found in the waste stream from the dozens of samples that were examined in each of these reports. Only residentially sourced samples were used in this compilation. Each individual report already contained a mean average for the different types of recyclable materials as well as non-recyclable materials from the numerous collected samples. For this analysis, the percentages of recyclables were recorded and averaged among all the residential data in the reports to provide a thorough estimation. See bottom highlighted row in Table 2 for the average percentages used after incorporating the data from the selected residential samples.

Similar calculations of the value of recyclables in MSW were done for ADEM in the June 2012 study, “Economic Impact of Recycling in Alabama and Opportunities for Growth”⁸. The concept remains the same – recyclable commodities have value and should not be discarded – but the results of this study incorporate changes in the recycling marketplace since 2011.

This study reflects differences in both the composition of recyclable materials and market prices since 2011.

The 2011 Alabama economic impact report used data from one MSW sortation study performed in 2005 for the Georgia Department of Community Affairs. Since then the recycling industry recognizes the “evolving ton”. This term acknowledges that due to rapid changes in packaging and consumer preferences, material shifts are occurring and certain materials are gaining or losing market share. The U.S. EPA reported in 2015 that the paper portion of the waste stream has fallen by 22 percent since 2000, while plastics have increased by 27 percent.⁹ Newspaper generation alone fell by 34 percent since 2006, according to the EPA report and estimates by the American

⁸ Michael Gavin Adams, Alabama Department of Environmental Management

⁹US EPA, Advancing Sustainable Materials Management

https://www.epa.gov/sites/production/files/2015-09/documents/2013_advncng_smm_rpt.pdf

Forest and Paper Association (FPA). Waste Management, Inc., one of the largest recycling companies in the U.S., reports that shipments of old newspapers to market declined by 12 percent between 2011 and 2013. According to the American Chemistry Council, rigid plastic container recycling increased by 10 percent just in the one-year period from 2011 to 2012.¹⁰ The consulting firm Resource Recycling Systems has documented a decline in glass, aluminum and steel packaging for several clients as well.¹¹

One of the most important new materials added to the recycling mix is aseptic and gabletop cartons. The Carton Council, a trade group of manufacturers that provide carton recycling assistance to communities, recently reported that 58 percent of communities in the US collected aseptic and gabletop cartons for recycling, a significant increase from 2010, when approximately 24% of communities were collecting this material.¹² Aseptic and gabletop cartons have commodity value and proven markets; therefore they are included in the estimated value.

Due to these well documented changes in the commodity mix since that study, the authors of this report chose instead to use a compilation of more recent characterization studies. Computers and scrap metal, included in the 2011 study, are not included here as they are beyond the scope of this study, which focuses on materials commonly accepted in curbside collection.

Adding up the average composition percentages for each commodity from the three referenced studies yields an approximation of 28.12 percent as the portion of residential MSW that is recyclable. Applying this calculated percentage to the 4,600,000 tons of residential MSW discarded by Alabamians reveals that approximately 711,436 tons, or 1,422,872 pounds, of MSW could be recycled in Alabama as an alternative to landfilling.

¹⁰ American Chemistry Council, <https://plastics.americanchemistry.com/Education-Resources/Publications/Making-Sense-of-the-Mix.pdf>

¹¹ Michael Timpane, "A New World Order", *Resource Recycling* Conference, October 2015

¹² Carton Council, <http://www.cartonopportunities.org/>

TABLE 2

RESULTS OF WASTE CHARACTERIZATION STUDIES

Study Location	Type	Paper				Plastic				Glass	Metal	
		Newspaper	Un-coated OCC/Kraft	Mixed Paper	Aseptic /Poly-coated cartons	#1 PET Bottles/Jars Other PET Containers	#2 HDPE Bottles (Natural and Colored), Other HDPE Containers	#3-#7 Bottles	Other Plastic Containers	Glass Bottles & Jars	Aluminum Beverage Containers	Ferrous Containers (Tin Cans)
Montgomery County, Maryland	Urban	2.1%	1.00%	10.40%	1.3%	1.50%	0.60%	0.10%	2.90%	1.40%	0.40%	0.90%
Montgomery County, Maryland	Urban	2.2%	1.20%	10.10%	1.9%	1.80%	0.70%	0.10%	3.20%	2.40%	0.40%	1.00%
Montgomery County, Maryland	Urban	2.6%	1.30%	10.10%	2.1%	1.80%	0.60%	0.10%	3.20%	1.60%	0.50%	0.80%
Montgomery County, Maryland	Urban	2.9%	2.30%	11.00%	1.0%	2.70%	1.00%	0.10%	3.50%	4.50%	0.70%	1.50%
Prince William County, Virginia	Urban	2.1%	2.70%	8.40%	0.8%	1.50%	0.90%	0.10%	3.70%	1.80%	0.50%	0.80%
Prince William County, Virginia	Urban	1.7%	6.80%	10.50%	0.6%	2.50%	1.30%	0.10%	4.10%	3.80%	0.80%	0.90%
State of Illinois	Urban & Rural	2.4%	4.30%	10.20%	0.20%	1.70%	0.90%	0.90%	2.80%	3.60%	0.70%	1.00%
State of Illinois	Urban	2.2%	4.30%	9.00%	0.20%	1.50%	0.90%	0.90%	2.60%	4.20%	0.60%	1.20%
State of Illinois	Rural	2.8%	4.20%	15.00%	0.20%	2.20%	1.30%	1.20%	3.60%	3.90%	1.00%	1.60%
Average for Residential		2.33%	3.12%	10.52%	0.92%	1.91%	0.91%	0.40%	3.29%	3.02%	0.62%	1.08%

The Price of Disposal

Residents of Alabama bear the cost of disposal of potentially recyclable materials directly or indirectly through the cost of services provided by waste haulers or local governments. The average landfill tipping fee in Alabama was reported in Shin's Columbia University study as \$40 per ton of waste in 2011.¹³ This figure aligns closely with a 2016 analysis of disposal fees in the southeastern United States done by the Environmental Research Education Foundation (EREF) that found an average regional tipping fee of \$44.46 per ton.¹⁴ Given the age of the Alabama tipping fee cited by Shin, the \$44.46 average was used to calculate the cost of disposing of the recyclable material.

The results of the waste stream analysis show that Alabama annually spends approximately \$31.6 million to dispose of potentially recyclable material.

A summary of the research is shown below in Table 3.

TABLE 3
SUMMARY OF LANDFILLED RECYCLABLES IN ALABAMA

Total Tons of AL Residential MSW, 2015	Percent of MSW Potentially Recyclable	Tons of Potentially Recyclable Material Discarded in AL in 2015	Average Southeast Landfill Tipping Fee per Ton	Cost to Alabama of Discarding Potentially Recyclable Materials in 2015
2,530,000	28.12%	711,436	\$44.46	\$31,630,445

The Value of Discarded Recyclable Materials

The price paid for disposing of recyclable commodities is significant, but it is only part of the story. These commodities represent lost industrial feedstock to companies that manufacture goods from recyclables. Using average commodities prices, and the recyclables characterization from Table 2, an estimate of the lost economic value of these materials is calculated.

The commodity index chosen for calculating the market value of the lost commodities is Recycling Markets Limited (RML), a membership database located at www.recyclingmarkets.net. It was chosen because it provides historical and geographic data which accounts for price fluctuations that periodically occur in recycling markets. The pricing presented here is drawn from three years of RML

¹³ Shin, 2014

¹⁴ Environmental Research Education Foundation (EREF) Analysis on Average Tip Fees. <http://www.wastedive.com/news/eref-study-west-coast-reports-highest-average-tipping-fees-other-regions/415294/>

data representing the southeast regional average prices published at the beginning of each month.

The market prices used in this report differ from those used in the 2011 economic impact study. According to consulting firm RRS, aggregated pricing for single-stream recyclable commodities has dropped from \$125 per ton in 2007 to \$77 per ton in 2015, a decline of almost 83%.¹⁵ While prices have recovered somewhat since then, the value of a “market basket” of recyclables is still worth considerably less than 2011. These differences were taken into account in the choice of the market index used.

Glass, despite its high recyclability, suffers from operational issues related to processing as well as logistical issues related to transportation that render its market value less than the cost to process it; therefore, in this analysis it was given a \$0 value. Aseptic and gable-top cartons are a newer commodity without a long pricing history, so their estimated market value is provided by The Carton Council, a trade group of carton manufacturers that assists communities with recycling programs for these packages. Assistance with pricing for the various grades of plastics was provided by the Association of Plastic Recyclers (APR).

Table 4 applies the RML three-year average pricing to the percentage of each commodity found in the waste stream from Table 2. The data shows that the State of Alabama forfeits an approximate \$83 million annually in the value of industrial feedstock materials disposed.

¹⁵ Timpane, Michael. “A New World Order”, Resource Recycling Conference 2015.

TABLE 4
 POTENTIAL MARKET VALUE OF RECYCLABLES DISCARDED AS WASTE IN ALABAMA

Commodity Material	Pct in Disposed Waste	Amount available in AL Residential MSW, Lbs	3-Yr SE Average Regional Price, \$/Lb	Potential Market Value
Newspaper	2.33%	117,898,000	\$ 0.03	\$ 3,536,940
Old Corrugated Containers (OCC)	3.12%	157,872,000	\$ 0.05	\$ 7,893,600
Paper (Soft Mixed)	10.52%	532,312,000	\$ 0.03	\$ 15,969,360
Aseptic/Gabletop Cartons	0.92%	46,552,000	\$ 0.04	\$ 1,862,080
PET Plastic	1.91%	96,646,000	\$ 0.15	\$ 14,496,900
HDPE Plastic (48% natural, 52% colored)	0.91%	46,046,000	\$ 0.30	\$ 13,813,800
Rigid Plastics (30% colored HDPE, 26% PP, 44% PET)	0.40%	20,240,000	\$ 0.17	\$ 3,440,800
Other Plastic Containers	3.29%	166,474,000	\$ 0.04	\$ 6,658,960
Glass Containers	3.02%	152,812,000	\$ -	\$ -
Steel Cans	1.08%	54,648,000	\$ 0.03	\$ 1,639,440
Aluminum Cans	0.62%	31,372,000	\$ 0.51	\$ 15,999,720
TOTAL	28.12%			\$ 85,311,600

The Economic Impact of Recycling in Alabama

The value of recovered materials is one facet of the economic impact of the recycling industry in Alabama. The use of recovered materials in the manufacturing supply chain also creates jobs, spurs investment, and contributes tax dollars in the local and state economy.

Part of the scope of work for this report was to conduct an accounting of this larger economic impact through an economic assessment provided by Dr. Frank Hefner of the College of Charleston, South Carolina. A list of over 2,000 Alabama companies associated with manufacturing was drawn from the Hoovers database and filtered to identify potential recycling companies. This short list of companies was then surveyed to determine their role in the recovered material economy and their associated economic contribution to the State of Alabama's economy.

One hundred twenty recycling-related companies in Alabama provided information about the contribution of recycling to their business and the larger economy. The full economic assessment report is included in the Appendix to this report. Its findings are summarized in Table 5 below.

TABLE 5
 ECONOMIC BENEFIT OF RECYCLING IN ALABAMA

Economic Benefit	Value to State of Alabama
Jobs	84,412
Business Income	\$4.5 Billion
Increased Economic Activity	\$19.4 Billion
State and Local Tax Revenue	\$765 Million

¹⁶

A comparable study performed in 2014 for the State of South Carolina by Dr. Hefner found that S.C.'s recycling industry contributed 54,121 jobs, \$2.6 billion in labor income, and nearly \$329 million in state and local taxes.

¹⁶ *The Economic Impact of the Recycling Industry in Alabama*, Frank Hefner, prepared for SERDC, June 30, 2016.

Section 2: State of Residential Recycling in Alabama

Alabama is a state characterized by small cities and a large rural population. Alabama’s largest city is home to less than a quarter million people, and its largest Metropolitan Statistical Area (MSA), the only one in the state with over a million residents, stretches over seven counties comprising more than ten percent of the state’s total land area.¹⁷

Recycling Systems used in Alabama

Table 6 lists the state’s ten most populous cities, which comprise approximately one-fourth of the states’ population. The forty next largest cities combined only include an additional one-fourth of the population, and half of the population of the state resides outside of urban MSAs.

TABLE 6
TEN LARGEST ALABAMA CITIES

Ten Largest Alabama Cities				
Population Rank	City Name	County	Population Census Est. 2014	Predominant Recycling Method
1	Birmingham	Jefferson	212,247	Curbside
2	Montgomery	Montgomery	200,481	Drop-off
3	Mobile	Mobile	194,675	Drop-off
4	Huntsville	Madison & Limestone	188,226	Curbside
5	Tuscaloosa	Tuscaloosa	96,122	Curbside
6	Hoover	Jefferson	84,353	Curbside
7	Dothan	Houston, Dale, Henry	68,409	Curbside
8	Auburn	Lee	60,258	Curbside
9	Decatur	Morgan & Limestone	55,532	Curbside
10	Madison	Madison & Limestone	46,450	Curbside
Total Population of 10 Largest Alabama Cities			1,206,753	

Note: Mobile residents are offered subscription curbside service by a private firm called Earth Resources. However, it is not city sponsored, and the number of participants is unknown.

¹⁷ Metropolitan and micropolitan statistical areas (metro and micro areas) are geographic entities delineated by the Office of Management and Budget (OMB) for use by Federal statistical agencies in collecting, tabulating, and publishing Federal statistics. A metro area contains a core urban area of 50,000 or more population, and a micro area contains an urban core of at least 10,000 (but less than 50,000) population. Each metro or micro area consists of one or more counties and includes the counties containing the core urban area, as well as any adjacent counties that have a high degree of social and economic integration (as measured by commuting to work) with the urban core. <https://www.census.gov/population/metro/>

Any characterization of the existing recycling infrastructure in Alabama must recognize both urban and rural areas. This report shows that curbside recycling is concentrated in the more urbanized areas, the more rural areas provide some drop-off recycling centers, but much of the state’s rural population has no access to residential recycling services.

Table 7 presents a snapshot of the recycling status for the 50 most populous cities and towns in the state of Alabama. Eighty-seven percent of the population in these cities have access to some recycling program. Only six municipalities were found to have no recycling access at all. Most cities and towns with curbside recycling offer single-stream collection, using either bins or carts. Two communities collect dual-stream in bins and two still rely on curbside sorts. Two curbside recycling programs use bags. Fifteen of these cities and towns provide only drop-off centers for their residents. A complete listing of these cities with details of their recycling programs is found in the Appendix of this report.

TABLE 7: TOP 50 CITIES

Summary of Recycling in Top 50 Alabama Cities	
Type of Recycling	Number of Cities / Towns
Single-Stream Carts	21
Single-Stream Bins	2
Dual-Stream Bins	2
Curbside Sort Bins	2
Curbside Bags	2
Drop-off	15
None Found	6
Total	50
Percent of Top 50 Cities Population with Recycling Access:	94%

Curbside Recycling

Alabama municipalities and counties that provide access to curbside recycling services were identified using internet research, results from the ADEM grant survey, phone calls, and data reported by communities in ReTrac that was provided by ADEM.

Generally, municipalities provide curbside recycling to single-family households, defined as those in buildings with four or fewer dwelling units. Buildings with five or more units are defined as multi-family and usually not provided with municipal curbside recycling. Since a detailed examination of multi-family recycling programs in Alabama is beyond the scope of this study, the population eligible for curbside

recycling includes single-family households and therefore is not equal to the total municipal population. The percentage of each municipality’s population living in single-family households was determined by reviewing U.S. Census data¹⁸, and the percentage was applied to the total population on an individual city basis to estimate the number of curbside eligible households.

The total number of cities and towns in Alabama with curbside recycling programs is shown in Table 8, along with their locations and the number of households served.

TABLE 8

Number of Cities and Towns in Alabama with Access to Curbside Recycling				
MSA or County (in order of population)	Number of Cities and Towns with Curbside Recycling	Population in Cities and Towns with Curbside Recycling	Population in Single-Family Households Served by Curbside Recycling	Single-Family Households Served by Curbside Recycling
Birmingham-Hoover MSA	24	554,599	443,057	167,775
Huntsville MSA	4	371,916	292,887	111,687
Montgomery MSA	1	7,661	6,688	2,128
Tuscaloosa MSA	1	96,122	60,461	19,998
Daphne-Fairhope-Foley MSA	4	64,515	49,565	18,634
Auburn-Opelika MSA	2	89,429	64,175	23,672
Decatur MSA	2	69,991	59,319	23,114
Dothan MSA	1	68,409	60,679	23,004
Florence-Muscle Shoals MSA	1	40,215	33,539	14,527
Anniston-Oxford-Jacksonville MSA	1	12,250	9,261	3,299
Marshall County	3	37,900	34,592	12,513
Cullman County	1	15,145	12,283	4,954
Talladega County	3	18,299	16,551	6,714
Jackson County	1	14,748	13,303	5,476
Coffee County	1	27,772	24,856	9,113
Covington County	1	9,081	8,373	3,247
Pike County	1	19,138	15,578	5,504
Totals for Curbside Recycling	52	1,517,190	1,205,165	455,360
State of Alabama Population:		4,858,979	Percent of Alabama population Served by Curbside Recycling:	25%

A total of fifty-two cities and towns in Alabama provide residents with access to curbside collection programs. Forty-one of these are located within census-defined Metropolitan Statistical Areas, and the remaining eleven are in non-MSA counties.

The total population in areas where curbside recycling programs are found is 1,517,190. An estimated average of 79 percent of the total population of these localities, 1,205,256 residents, lives in single-family households and thus has access to curbside recycling. This represents approximately 25 percent of the total population of Alabama.

¹⁸ US Census Bureau, <http://www.census.gov/quickfacts/table/PST045215/00>

The curbside recycling access for Alabama was compared to two other states in the southeast in Table 9.

TABLE 9

CURBSIDE RECYCLING ACCESS IN OTHER SOUTHEASTERN STATES

State	Percent of Population with Curbside Recycling
South Carolina	45.9
North Carolina	72.8

About half of Alabama’s curbside programs are located within 30 miles of Birmingham, Alabama’s largest city. Another cluster of curbside programs is located within 30 miles of Huntsville, the state’s fourth largest city.

Alabama’s second and third largest cities, Montgomery and Mobile, do not provide curbside recycling. Mobile relies on two drop-off centers, one operated by the City and one by the County of Mobile. Montgomery participated in an experimental program to separate recyclables from mixed waste. Program results were mixed, with plastics markets claiming the material met their specifications and paper markets claiming excessive contamination and loss of material to the landfill. In October, 2015, the owner of the mixed waste processing facility made the decision to close it.

The number of households served with curbside recycling is approximately 455,360. The participation rates for these communities, which represents the number of households that actually use the service, is unknown. Participation rates vary widely among different communities for various reasons. While it was beyond the scope of this study to document this, recycling industry experts agree that best practices in education and promotion for residents can boost recycling rates measurably¹⁹. This report includes promotion and education best practices in the Recommendations section.

In addition to promotion and education, providing residents with curbside recycling collection automatically, instead of requiring them to pro-actively ask for a recycling bin or cart, and providing recycling access free of charge (or as a part of an existing utility bill or fee) instead of charging a separate recycling fee, also positively impacts participation behavior. Communities in Alabama should provide equal or “universal” access to recycling in all neighborhoods. This best practice is discussed in more detail in the Recommendations section of this report.

¹⁹ The Recycling Partnership, Case Studies: <http://recyclingpartnership.org/city-of-durango-colorado/>

Three cities in Alabama only provide residents with bins if they request them, and two of these charge special recycling fees. Residential cart uptake, and thus participation, is reported as follows.²⁰

- Dothan residents must register online to request a recycling bin. Exact numbers of residents with bins is not known, but city officials estimate that between 10,000 and 15,000 of the 24,000 eligible households have bins.
- Opelika residents must sign up online, and also pay a fee of \$10 per month. City officials report that only about 10% of eligible households, 700 out of 7,000, are on board.
- Oxford offered residents an opportunity to sign up for curbside recycling by calling the private service provider, Republic Services, and agreeing to pay \$5.50 per month. The City was unable to recruit enough residents to establish the program.

Drop-off Recycling

Generally, rural areas rely on drop-off recycling, as the population is less concentrated and curbside recycling is impractical. Drop-off recycling services may be provided by counties and cities. This study looked at recycling in Alabama's twenty-one most populated counties, representing 75% of the state's population, to document the extent to which drop-off recycling services are provided. The information was gathered using internet research, ADEM data, and conversations with local government recycling officials.

Seventeen of these twenty-one counties provide drop-off recycling services for residents. Six operate drop-off systems themselves, three rely on not-for-profit organizations or multi-jurisdictional agencies, and eight rely on city drop-off centers to serve their residents. Many of these counties rely on only one drop-off center to serve the entire county population, often located in and operated by a town or city and not the county itself. Madison County is the only Alabama county with county-wide curbside recycling service, provided by Republic Services. Three counties do not offer any drop-off recycling services, nor do any of the cities within their borders.

The counties that do offer drop-off recycling account for 89 percent of the total population of the twenty-one largest counties in Alabama, and about 67 percent of the total population of the state. Again, participation is difficult to estimate since some counties provide multiple drop-off locations but others only provide limited opportunities through fewer centers.

Only seven out of Alabama's remaining 46 counties could be verified as having recycling drop-off programs, for a total of 25 counties providing recycling programs for residents. The remaining counties are very rural with low population density.

Drop-off centers are an important link in the recycling supply chain. They provide opportunities to capture valuable recyclables from rural residents for whom curbside

²⁰ Information from conversations and emails with municipal representatives

recycling is impractical. Even if rural residents cannot utilize curbside recycling, they can still be offered the convenience of single-stream recycling at drop-off centers if single-stream MRFs are available. Collecting common household recyclables single-stream at drop-off centers provides convenience to users and efficient transportation to processors.

Drop-off centers can also be used to capture other materials typically not included in curbside programs for which rural residents may have difficulty finding recycling options. These materials can include used motor oil and filters, used tires, electronics, lead-acid vehicle batteries, and rechargeable batteries. Glass may also be collected in separate containers, avoiding contamination of single-stream recyclables and ensuring high quality glass.

This report recommends that even rural, sparsely populated counties should provide access to comprehensive drop-off recycling programs for their residents. Best practices for drop-off centers can be utilized to optimize ease of use, keep contamination to a minimum, and transport efficiently. Such practices are discussed in the Recommendations section of this report.

Materials Processing in Alabama

While Alabama has a fairly robust network of cities with curbside recycling, particularly close to the major metropolitan areas, its processing network is fragmented and lacks sufficient capacity to manage growth in curbside recycling.

Alabama has a total of 177 recyclables processing facilities with various capacities that are registered with the state via ADEM. Some of these processing facilities could be called “MRFs”, or material recovery facilities. MRFs have the capacity to sort and process single-stream or dual-stream material, collected from both curbside and drop-off recycling programs, into truckload quantities suitable for sale to end-use markets. Other facilities could be classified as “RPCs”, or recycling processing centers, with limited capacity to sort and process material, and possibly selling some grades to end-users but dealing with local material handlers or brokers. Some of the facilities are local scrap metal or paper dealers.

All Alabama processing facilities are required to report the material tonnage they manage to ADEM through the Re-TRAC Connect system, but not all facilities are up-to-date on reporting requirements.

This report examined the types of facilities that report to ADEM, and also surveyed cities and counties, to determine that approximately thirty-one facilities can be classified as MRFs or RPCs, with the majority of the material they process comprised of typical household recyclable materials – various grades of paper, metals, plastics, and sometimes glass. Scrap metal yards that accept limited amounts of pre-sorted household recyclables, and recycling centers that do no sorting, but either rely on residents to pre-sort or ship unsorted materials to other processors, are not counted as MRFs or RPCs. One of these facilities handles some Alabama recyclables but is located in Columbus, Georgia. Based on interviews with facility operators and local government recycling coordinators, annual operating

capacities were estimated for these MRFs and RPCs. Some facilities did not respond to requests for information. The data is presented in Table 10.

TABLE 10
ALABAMA RECYCLABLES PROCESSING CAPACITY²¹

Summary of Recyclables Processing Capacity in Alabama					
Facility Name	Type	Location	Owner	Operator	Capacity Tons/Year
Birmingham Recycling & Recovery	MRF	Birmingham	Cellmark, Inc.	Birmingham Recycling & Recovery	19,200
Huntsville Recycling Center	MRF	Huntsville	Huntsville Solid Waste Authority	Republic Services	18,000
City of Florence Recycling Center	MRF	Florence	City of Florence	City of Florence	3,900
City of Decatur Recycling Center	MRF	Trinity	City of Decatur	City of Decatur	3,000
City of Guntersville	MRF	Guntersville	City of Guntersville	City of Guntersville	3,000
Lee County Recycling Center	RPC	Opelika	Lee County	Lee County	2,900
Tuscaloosa Recycling Center	RPC	Tuscaloosa	City of Tuscaloosa	City of Tuscaloosa	2,268
Alabama Environmental Council (AEC)	RPC	Birmingham	AEC	AEC	2,200
Athens/Limestone Recycling Center	RPC	Athens	City of Athens	Keep Athens/Limestone Beautiful	2,000
Albertville/Boaz Recycling Center	RPC	Albertville	City of Albertville	Albertville/Boaz Recycling Authority	2,000
Mobile County Recycling Center	RPC	Mobile	Easter Seals	Easter Seals	1,320
Shoals Recycling Center	RPC	Tuscumbia	Colbert County	Shoals Solid Waste Authority	1,200
Coffee County Material Recovery Program	RPC	Elba	Coffee County	Coffee County	767
Baldwin County Recycling Center	RPC	Summerdale	Baldwin County	Baldwin County	740
City of Andalusia Recycling Center	RPC	Andalusia	City of Andalusia	City of Andalusia	730
City of Gadsden Recycling Center	RPC	Gadsden	City of Gadsden	City of Gadsden	600
Calhoun County Recycling Center	RPC	Anniston	Calhoun County	Calhoun County	400
City of Troy Recycling Center	RPC	Troy	City of Troy	City of Troy	Unknown
Scottsboro Recycling Center	RPC	Scottsboro	City of Scottsboro	City of Scottsboro	Unknown
Alexander City Recycling Center	RPC	Alexander	City of Alexander	City of Alexander	Unknown
Town of Fairhope Recycling Center	RPC	Fairhope	Town of Fairhope	Town of Fairhope	Unknown
Clay County Recycling Center	RPC	Lineville	Clay County	Clay County	Unknown
City of Dothan Recycling Center	RPC	Dothan	City of Dothan	City of Dothan	Unknown
Elmore Correctional Center	RPC	Elmore	AL Dept. of Corrections	AL Dept. of Corrections	Unknown
City of Gulf Shores Recycling Center	RPC	Gulf Shores	City of Gulf Shores	City of Gulf Shores	Unknown
Ft. Payne Recycling Center	RPC	Ft. Payne	City of Ft. Payne	City of Ft. Payne	Unknown
Earth Resources	RPC	Mobile	Earth Resources	Earth Resources	Unknown
Tarpon Paper	MRF	Loxley	Private	Private	Unknown
JCR Recycling	MRF	Cullman	Private	Private	Unknown
Mount Scrap	RPC	Montgomery	Private	Private	Unknown
Pratt Industries	MRF	Columbus, GA	Private	Private	50,000

Using ADEM data from the Re-TRAC Connect reports to attempt to estimate the existing and necessary future capacity of residential MRFs and RPCs is challenging because the registered facilities reporting to ADEM manage additional materials. ADEM collects data on the actual amount of material received, and then either marketed or transferred, by MRFs, RPCs, scrap metal yards, and other material

²¹ While the authors of this report attempted to be comprehensive in locating facilities and obtaining their information, it is possible that some small facilities were missed.

handlers. The reports include industrial recycling, commercial and demolition (C&D) recovery, and recycling of other materials such as computers, batteries, and motor oil in addition to typical residential recyclables. Some of the residential recyclables reported, such as paper, plastic bottles, and metals, may originate at commercial or industrial locations. ADEM reported a total of 1,353,327 tons of material from all sources were recycled or diverted from disposal in fiscal year 2015.

Based on Table 10, it is possible to attempt to calculate the existing residential material processing capacity in Alabama. If the average capacity for the 13 public facilities for which capacity is known is applied to the remaining public and private locations with unknown capacity, the current existing processing capacity for the 31 identified Alabama processors is 87,647 tons per year.²² Since glass is not included in most Alabama residential programs, the total could be considered “light” if compared to other states where residential glass recycling is more common.

The existing residential processing capacity represents only a fraction of the total recycled or diverted. The estimate is derived from a very small sample of the ADEM registered facilities that reported in 2015. Additionally, for 13 out of the 31 facilities, capacity was estimated using an average of those known. A more thorough discussion of processing needs is presented in Section 3 of this report, Recommended Best Practices.

Evaluating the Adequacy of Recyclables Processing Infrastructure

Determining the adequacy of Alabama’s existing processing capacity to handle current recycling collection volumes, and to determine sufficiency of processing capacity to handle expansion and improvement of recycling programs statewide, is challenging for a number of reasons.

- Alabama does not require cities, towns, or counties that only collect material to report the tonnage collected and delivered to the processor.
- Local jurisdictions that process material are required to report the amounts they receive, but not to identify the sources of material – for example how much is collected from drop-off centers separately from how much is collected curbside, and which cities or towns use the facility.
- Cities and towns that provide curbside collection in a particular county mostly do not deliver that material to the county facility if one exists.
- Many smaller processing centers will bale some materials, for example paper or PET plastics, for sale to end markets, but deliver others in bulk to local markets or brokers.
- Current market prices for recyclables are at a low point due to the depressed petroleum economy, and contamination at MRFs and mills is compounding the problem by increasing processing costs. This situation is causing some processors

²² Pratt is not included in this total, because it is located out of state, and because only a portion of its capacity could be available to Alabama programs.

to attempt to charge a tipping fee for recyclables, putting local government programs under pressure.

Grant Funding to Processors

It should also be noted that the State of Alabama, through the ADEM Recycling Grants Program outlined in Solid Waste Administrative Code chapter 335-13-10, provides grant funding to communities for recycling infrastructure. Several of the recycling processing centers listed have received grant funds for equipment and facility improvements. While a complete analysis of these communities’ grant expenditures is beyond the scope of this study, it is possible to identify the ones that used grant funds for processing equipment and to assess the impact of those expenditures on material recovery in Alabama.

A list of the publicly operated RPCs that this report identified as recipients of grant money for balers and associated support equipment such as scales and forklifts is presented in Table 11, with the actual reported capacity of these RPCs. It should be noted that this data is likely incomplete and other recycling centers have received balers, but did not reply to the grants survey conducted as part of this report. A discussion of the grants survey is found on page 50. A summary of the impact of the grants program in Alabama and suggestions for improvements are included in the Recommendations section of this report.

TABLE 11: ADEM GRANT SUPPORT OF PUBLICLY OWNED RPCS

RPC with Grant Funded Equipment	Reported recovery Tons per Year
Alexander City	Not Available
Athens/Limestone County	2,000
Calhoun County	400
Clay County	Unknown
East Alabama Recycling Partnership	2,900 (Lee County)
Florence City	3,900
Gadsden City	600
Mobile County	1,320
Pickens County	Unknown

Only one of these processors that have benefited from Alabama Recycling Fund grants handles curbside collected material, the City of Florence. The Athens/Limestone County Recycling Center processed the City of Athens curbside recyclables until 2013, when Athens switched to single-stream cart collection and began delivering to the single-stream facility in Decatur instead. Calhoun County and Lee County (representing the EARP) include cities with curbside recycling programs, but do not process the material collected in these programs. While the East Alabama Recycling Partnership manages the grant funding for Lee County and the Cities of Auburn and Opelika, it is a partnership in the administrative sense only, as the recyclables from these three jurisdictions are collected, processed, and marketed differently; the Lee County Recycling Center does not function as a

regional processing center. No curbside programs are found in Alexander, Gadsden, Clay County, or Pickens County.

Optimizing Recyclables Processing in Alabama

This report recommends and describes in detail the establishment of a network of large, regional processing center “hubs” and recyclable transfer station “spokes” that can work together to maximize the tonnage and the value of recyclables collected from every Alabama community. The current system of small, inefficient processing centers limited in capacity yet generously funded by ADEM will not function as the engine that drives Alabama to become a dependable, consistent and large supplier of recovered materials to the industries that need them.

If Alabama is to be recognized as a leading supplier of recovered industrial feedstock, creating jobs and economic growth via a modern infrastructure, it must organize its flow of material in a truly regional system. Local government recycling programs will need to specialize in collection, aggregation, and transportation, and private sector recycling companies will be drawn by this consistent material supply to invest in the necessary processing capacity in the right place. The state can incentivize this through its recycling grant program and outreach to the private sector.

Recycling Markets

Alabama has a number of end-users for recovered commodities, including paper, plastics, and metals.

Paper

Alabama has significant paper production capacity, both virgin (tree pulp sources) and recycled. Table 12 below lists the recycled paper mills and their locations.

TABLE 12: PAPER MILLS USING RECYCLED PULP

Mill	City
Activa	Birmingham
Alabama River Newsprint	Perdue Hill
Boise Inc. - Jackson Mill	Jackson
Bowater -Coosa Pines Mill	Coosa Pines
International Paper Co. - Prattville Mill	Prattville
International Paper, Pine Hill Mill	Pine Hill
Kimberly-Clark Corp. - Mobile Mill	Mobile
MeadWestvaco - Mahrt Mill	Cottonwood
National Gypsum Co. - Anniston Mill	Oxford
Newark Recycled Fibers - Mobile Paperboard Corp	Mobile
SCA Tissue North America, L.L.C. - Barton Mill	Cherokee
Sonoco Products Co.	Florence

Plastics

Alabama is home to the largest plastics recycler in North America, KW Plastics in Troy. KW is a leading recycler of polypropylene and polyethylene, with postconsumer grades including HDPE natural and colored bottles, HDPE injection molded rigid containers (such as yogurt cups), PP rigid containers and parts (including lead acid battery casings), and PP woven shipping sacks. In 2015, KW purchased approximately 4.4 million lbs of plastics from Alabama processors. These included 8 private processors and one local government recycling center.

Custom Polymers PET, located in Athens, Alabama, purchases bales of postconsumer PET bottles, along with other forms of PET scrap, and manufactures pellets for use in new PET bottles and other packaging and non-packaging products. In 2015, Customer Polymers PET purchased recovered material from 11 Alabama processors, including 5 private companies and 6 local government recycling centers. The tonnage recycled is proprietary information.

Metals

Alabama has a number of steel producing mills that are equipped with modern electric arc furnaces enabling them to use 100 percent recycled scrap as feedstock. These facilities are listed in Table 13.

TABLE 13: ALABAMA STEEL MILLS²³

Company Name	AL Location	Annual Capacity	Number of Employees	Electric Arc Furnaces	Other Recycling Capability
American Cast Iron Pipe	Birmingham	N/A	1600	Yes - 5	
CMC Steel Alabama	Birmingham	750,000 tons raw steel. 600,000 tons rolling mill	330	Yes - 1	
Gerdau Long Steel North America (Birmingham Reinforcing Steel)	Birmingham	N/A	N/A	Yes - 1	Rebar contains recycled content
Gerdau Long Steel North America (Trussville Reinforcing Steel)	Birmingham	N/A	N/A		Rebar contains recycled content
Nucor Steel	Birmingham	N/A	N/A	Yes - 1	
	Decatur	2.4 million tons	730	Yes - 2	
	Tuscaloosa	N/A	425	Yes - 1	
Outokumpu Stainless	Calvert	440,000 tons hot rolled black. 385,000 tons cold rolled. 165,000 tons hot rolled white	N/A	Yes - 1	
SSAB Axis Steel Works	Axis	1,250,000 tons	450	Yes - 1	

Constellium USA, formerly Wise Alloys, operates one of the largest and most modern aluminum recycling facilities in the world in Muscle Shoals. Constellium manufactures can sheet for beverage giants Anheuser-Busch (owned by Inbev) and Pepsi-Cola at the Muscle Shoals plant. This mill purchases approximately 400 million pounds of used beverage containers (UBCs) per year, and sources from the U.S. and Mexico. The mill's major buying arm is Anheuser-Busch Recycling. Constellium enforces its quality standards slightly differently from its competitors

²³ Association for Iron and Steel Technology (AIST), [2014 Directory of Iron and Steel Plants: Alabama Power Company](#)
<http://amazingalabama.com/presentation/pdf/metal.pdf>;
AL.Com
<http://blog.al.com/press-register-business/2012/06/ssab-starts-production-at-axis.html>;
[Wall Street Journal](http://www.wsj.com/articles/steel-firms-in-u-s-scrap-old-methods-to-compete-1434574049)
<http://www.wsj.com/articles/steel-firms-in-u-s-scrap-old-methods-to-compete-1434574049>
[Tuscaloosa Chamber of Commerce](http://www.tuscaloosa.com/Assets/Government/Department-Documents/Economic-Development/Copy%20of%20Copy%20of%202014%20Top%20Employers%20List%203-17-14.pdf)
<http://www.tuscaloosa.com/Assets/Government/Department-Documents/Economic-Development/Copy%20of%20Copy%20of%202014%20Top%20Employers%20List%203-17-14.pdf>

Novelis and Alcoa, accepting some bales of lower quality at a reduced price rather than rejecting loads.

Glass

Glass markets are limited in the southeast, not only in Alabama. Strategic Materials in Atlanta is the major glass market for Alabama communities. Very few communities in Alabama accept glass for recycling, but those that do mostly send it to Strategic. Even the City of Fairhope, in the southwestern corner of the state, moves its glass to Atlanta. The City pays \$240 per load, which is half the freight cost, to ship the glass in open-top tractor trailers. Since the material is not color-sorted, it is used for asphalt underlayment and not new glass containers.

This report includes a recommendation that glass recovery be added to Alabama's community drop-off recycling programs, but not into curbside collection. Evaluating the existing processing capacity and planning for new capacity must consider the need to manage glass, which this report does include in its recommendations for a common suite of materials to be collected.

A discussion of glass issues is presented in the Best Practices recommendations for Drop-off Recycling and Common Suite of Materials.

Section 3: Best Practices Recommendations for Expanding and Improving Recycling in Alabama

Best Practice: “Hub and Spoke” System

The State of Alabama should optimize the collection, transportation, processing and marketing of recyclables along a system of “hubs” and “spokes”, enabling a standard system of recycling practices to reach the entire population by transferring unprocessed or semi-processed recyclables from the rural areas and smaller towns to the larger cities where final processing and marketing can be done.

This section of the report presents an outline of a “hub and spoke” recycling collection, transportation and processing system for the State of Alabama. This outline describes a systematic approach to maximizing material recovery most efficiently.

Definition of Hub and Spoke

Hubs are central locations for the processing of recyclable materials by MRFs. A hub may feature one or more MRFs depending on the capacity needed. Spokes are transportation corridors that connect these hubs with recyclables transfer stations located in smaller cities or towns. Hubs combine recyclables collected by smaller jurisdictions into larger loads to be marketed directly to end users.

Hubs offer a number of benefits to a state and its municipalities. They encourage economies of scale in construction and operation, and thus greater efficiency. They may be able to command better market prices due to their volume. Hubs also eliminate duplication of effort on the part of many small communities that would no longer need to establish expensive processing centers in order to market their recyclables.

Hubs can also benefit the state in making tracking and reporting of recyclables easier and more accurate, as fewer locations report and reporting forms can be standardized. Grant funding can also be used more effectively and avoid duplication of effort.

Other State’s Experience

Pilot hub and spoke programs have been implemented in the states of Georgia, Colorado, and New Mexico. In 2007, Georgia was the first to attempt to spread single-stream recycling collection and processing throughout the state. Two main goals of the program were to locate processing hubs with 50-mile radius sourcing areas, and to attract private investment to build the necessary processing infrastructure. The Georgia Department of Community Affairs (DCA) assembled stakeholders from the public and private sectors to develop the hub system. Hub grants were provided by the DCA to help communities build up or expand single-stream recycling infrastructure. To qualify for grants, communities were required to target new materials for collection, accept single stream recyclables from a 50-mile radius, leverage private-sector support, use and promote the statewide recycling

campaign, and measure and report the amount of recyclables they collected.²⁴ By 2009, four hubs were established by local governments through the grant program, and two more by private recycling processors. The results of the program from 2009 included:

- New curbside recycling programs in areas where it was previously not cost-effective;
- A 185 percent increase in collected recyclables from the four grantee communities;
- Over 600 tons per month of new recyclables from one hub location;
- Approximately \$500,000 in avoided tipping fees (at \$35 per ton GA statewide average);
- Approximately \$370,000 in increased revenue for hub host communities.

Since 2009, the Georgia DCA has reduced its recycling assistance activities and hub grants were discontinued. However, recent conversations with Randy Hartmann, former Director of the DCA's Office of Environmental Management, revealed some valuable lessons learned:

- Compaction is key to moving recyclables long distances, but glass is problematic to include in compacted loads;
- Communities must be persuaded that they can work in partnership with surrounding communities, and that each local government doesn't need its own MRF.
- The program design must recognize and address local community needs, instead of imposing a fully developed scheme from the top down.
- The hubs and the smaller "spoke" communities need help with contract development, so that the transferring remote communities can be sure they have destination for their recyclables, and the hubs can be sure they will have sufficient material to be cost-effective.
- Awarding grant money is important, but building trust and confidence in the system is also vital to ensuring that communities will work together and that the private sector will feed comfortable entering the marketplace.
- Participants need to understand the metrics that will be used to evaluate the system's success, and have a consistent system for gathering and reporting the data.

Experience from the State of New Mexico reinforces the Georgia experience. New Mexico found that a regional hub based recycling system to transfer material from its rural communities to centrally located MRFs provided the following benefits:

- Replicability and regional consistency
- Economies of scale – larger MRFs have lower per-ton costs if operated at capacity
- Reduced capital demands and fewer dollars invested in redundant capacity
- Stakeholder partnerships

²⁴ "Go Bold", Randy Hartmann. *Resource Recycling*, October 2009, pp 32-35.

Hub and Spoke for Alabama

A hub and spoke system for Alabama would be constructed on four foundational pillars:

1. Local governments provide curbside recycling for single-family residents in cities or towns with over 5,000 in population, and drop-off convenience centers for multi-family and rural residents,
2. Existing solid waste transfer stations or local recycling facilities receive and load recyclables into bulk transfer trailers,
3. Large-scale regional material recovery facilities (MRFs) are built and operated by private recycling companies in central locations to receive, process, and market the recyclables
4. ADEM facilitates the cooperative development of the system by working with all stakeholders to recruit private sector investments in MRF facilities, provide grant funding for collection and transportation infrastructure to local governments, assist with contracts between communities and MRF processors, and provide a data collection and reporting system.

While recognizing the investment made by the State and local communities, as well as the private sector, in the processing network that currently exists, this report did not attempt to direct all new potential recyclables to these existing processing facilities. Instead, the population, geography, and transportation routes for the state were examined, along with the current knowledge about recycling collection and processing in the state, to identify productive “MRF-sheds” of materials and calculate potential processing capacity needed for these materials. In some cases, the existing facilities are recommended as hubs. In other cases, they are recommended as transfer points for aggregating transporting recyclables to the hubs.

Material Generation and Required Hub Capacity

The methodology to calculate household recycling potential is described below:

- The boundaries of each regional waste shed were identified, each having the components of a central city to host a MRF along with access to the central location on Interstate and State of Alabama developed highways.
- The total amount of potential household recyclables in each region was calculated using the methodology in Section 1 of this report that identified 28.1 percent of the total residential MSW as recyclable.
- The necessary processing capacity in tons per day was calculated for each region, and the value of the material also calculated based on the composition of the recyclables and market prices as in Section 1.
- Transfer stations in each county within the regions were identified as aggregation centers for recyclables, as were existing RPCs if appropriate

In order to ensure that the numbers being used to calculate the potential recycling recovery from Alabama’s hub regions were realistic and consistent with the actual experience of other communities, these figures were compared to actual recovery data obtained by communities that have tracked and documented their residential curbside materials recovery. The data from four different programs are presented in Table 14.

TABLE 14
RECOVERY IN OTHER JURISDICTIONS²⁵

Jurisdiction	Reported Recovery		Source
	Lbs/Household/Year	Lbs/Household/Mo.	
City of Austin	482	40	Actual HH Serviced
City of Minneapolis	519	43.25	Actual HH Serviced
Palm Beach County, FL	452	36.7	Single-Family HH
State of Wisconsin	348	29	Single-Family HH

In Section 1 of this report, a per-capita municipal solid waste generation rate for Alabama was estimated at 2.59 pounds per person per day. The amount of that material composed of household recyclable materials was estimated at 28.1%, meaning that each Alabama resident generates approximately .73 pounds of recyclables each day. U.S. Census data reports that the average household size in Alabama is 2.6 persons, so each household generates about 691 pounds of recyclables annually.

The 691 pounds per household per year represents the maximum amount of recovery available. Setting a 100 percent recovery goal for Alabama is unrealistic. While each household may generate 691 pounds of recyclables annually, variables that include participation rates, educational effectiveness, loss of recyclables from contamination, and other factors will act to reduce that number.

Private companies that design and build MRFs generally size them to accommodate approximately 35 pounds per household per month, which works out to 420 pounds per household per year, and then build in an extra 25 percent to accommodate additional recyclables that may come from commercial generators or new

²⁵ City of Austin, Texas <https://austintexas.gov/2015DiversionStudy>;
City of Minneapolis Office of Solid Waste and Recycling
<http://www.minneapolismn.gov/solid-waste/about/stats/index.htm>;
Solid Waste Authority of Palm Beach County, Florida
<http://swa.org/Archive.aspx?AMID=40>;
State of Wisconsin Department of Natural Resources
<http://dnr.wi.gov/topic/recycling/studies.html>

programs.²⁶ The end result is a planning generation rate of 525 pounds per household per year.

Based on a careful consideration of data showing Alabama’s maximum possible recovery, tempered with the real-world experience of high-performing communities around the country, the authors of this report are using a 525 pound per household per year estimate of recycling generation to plan the capacity of the hub and spoke system.

Organization of Hubs and Spokes for Alabama

This report recommends a total of eight regions in Alabama to be served by hub MRFs. These are summarized in Table 15 and the counties in each region are listed in Table 16. A description of each region follows.

TABLE 15
HUBS AND SPOKES

Region	Hub Location	Number of Counties	Total Population	Number of Curbside Programs	Curbside Population	Total Recyclable Tonnage
1	Florence	3	178,646	5	81,137	23,728
2	Huntsville	3	500,233	8	409,931	66,442
3	Decatur	5	350,225	4	109,658	46,517
4	Birmingham	15	1,597,013	45	900,426	212,118
5	Tuscaloosa	9	325,333	3	128,013	43,211
6	Montgomery	28	1,071,872	24	530,300	142,368
7	Mobile	2	619,104	13	340,985	82,230
8	Columbus, GA	2	216,653	4	132,220	28,776
Totals		67	4,859,079	106	2,632,670	645,391

The curbside single-stream material collected by communities in the regions would be hauled by the collectors to either county solid waste transfer stations or existing RPCs, where it would be loaded into either walking-floor trailers or compacting transfer trailers, then shipped to the MRF hub. These loads would contain all of the common suite of materials except glass, allowing compaction without the breakage and contamination issues involved with glass. The drop-off material would include the same single-stream recyclables as the curbside mix, and glass collected separately. Glass may be collected in roll-off boxes, or directly in bunkers. It may be color separated or mixed. These decisions will be made dependent on the end markets for the glass. It may be that the drop-off centers market their glass direct to market, or that they ship it in roll-offs to the MRF hubs to be combined with other loads and marketed from that central location.

²⁶ Conversations with Michael Timpane, Vice-President, Process Optimization and Material Recovery, Resource Recycling Systems

Historically, ADEMs grant program has invested in processing equipment for small county recycling centers to process and market their own material along with any other recyclables they choose to accept from other jurisdictions. Better economies of scale are achievable in larger MRFs, enabling much greater overall material recovery in the state. While these local jurisdictions have done an admirable job in setting up processing systems, establishing curbside and drop-off programs, and finding markets for materials, today's recovered materials economy demands consistent large supplies of these commodities. To play on this field, the smaller RPCs need to become spokes in a system that relies on hubs to maximize efficiency and return on investment. The new role for these jurisdictions will be as managers of transportation centers as opposed to small individual processing centers. ADEM grants, as recommended in this report, should focus on providing the equipment needed to establish such transportation centers.

TABLE 16
HUB AND SPOKE REGION COUNTIES

Region 1	Region 2	Region 3	Region 4	Region 5	Region 6		Region 7	Region 8
Lauderdale	Madison	Morgan	Jefferson	Tuscaloosa	Montgomery	Clarke	Mobile	Lee
Colbert	Marshall	Limestone	Shelby	Pickens	Houston	Randolph	Baldwin	Russell
Franklin	Jackson	Cullman	Calhoun	Marengo	Elmore	Monroe		
		Lawrence	Etowah	Fayette	Autauga	Butler		
		Winston	St. Clair	Hale	Coffee	Macon		
			Talladega	Lamar	Dale	Henry		
			DeKalb	Choctaw	Dallas	Washington		
			Walker	Sumter	Tallapoosa	Crenshaw		
			Blount	Greene	Covington	Clay		
			Chilton		Escambia	Conecuh		
			Marion		Chambers	Wilcox		
			Cherokee		Pike	Coosa		
			Bibb		Geneva	Bullock		
			Cleburne		Barbour	Lowndes		
			Perry					

Region 1: Florence

Region 1 includes three counties with a total population of 178,646. The region includes five curbside recycling programs, in Florence, Muscle Shoals, Russellville, Sheffield and Tuscumbia, with the remainder of the population served by drop-off centers. The processing hub would be located in Florence, at the existing City of Florence Recycling Center. This facility was chosen because it has been in operation for a long time, the state has invested over \$1 million in grant funding in the facility, and the City has received a carts grant from The Recycling Partnership that also included state of the art educational tools.

The counties of Lauderdale, Colbert and Franklin would aggregate recyclables at the existing transfer stations and deliver recyclables to Florence. The Shoals Solid Waste Authority Recycling Center in Tuscumbia would serve as another recycling transfer point. The transfer logistics are shown in Table 17.

TABLE 17: REGION 1

Hub Destination: City of Florence Recycling Center			
Counties	Transfer Points	Distance to Hub, Miles	Highways
Lauderdale	County SW Transfer Station	8	Local Roads
Colbert	County SW Transfer Station	8.2	US-43 N / US-72 E
	Shoals Recycling Center	7.2	US-43 N
Franklin	SW Disposal Facility	30.9	US-24 E / US-43 N

Region 1 would potentially generate 23,728 tons of recyclable material annually, based on 691 pounds per household per year. Using the planning recovery figure of 525 pounds per household per year yields 18,037 tons per year of recovery that must be processed.

MRF designers plan on utilization of 26 days per month, two shifts per day, 6.5 working hours per shift.²⁷ Based on this formula, the capacity rate of the MRF needed is 4.4 tons per hour.

The current reported capacity of the City of Florence Recycling Center is 3,900 tons per year. The facility would need to grow to almost five times its existing capacity to manage the projected regional tonnage. Such an investment is beyond the ability of any one local government agency, and MRFs this size are more efficiently operated by the private sector. The State of Alabama would work with the local government agencies on interlocal agreements to ensure the availability of the tonnage, assist these communities in procuring the necessary collection and transportation equipment, and then recruit a private sector operator for this large regional MRF.

²⁷ Michael Timpane

Region 2: Huntsville

Region 2 includes three counties with a total population of 500,233. The region includes eight curbside recycling programs, in Albertville, Arab, Boaz, Guntersville, Huntsville, Madison, Scottsboro and the unincorporated areas within Madison County. The remainder of the population is served by drop-off centers. The processing hub would be located in Huntsville, at the existing Huntsville Solid Waste Authority Recycling Center, operated by Republic Services. This facility was chosen because it is a large single-stream MRF, privately operated, that has been in operation for a long time and was recently updated per a conversation with the facility manager.

The counties of Marshall and Jackson would aggregate recyclables at the existing recycling centers located in Guntersville and Scottsboro respectively. Madison County is already serviced with curbside recycling county-wide from Republic Services and delivering the material directly to the MRF. Table 18 summarizes the logistics for Region 2.

TABLE 18: REGION 2

Hub Destination: Republic Services Huntsville Recycling Center			
Counties	Transfer Points	Distance to Hub, Miles	Highways
Madison	None, County curbside direct		
Marshall	Guntersville Recycling Center	41.3	US-431 N
	Albertville/Boz Recycling Center	41.3	US-431 N
Jackson	Scottsboro Recycling Center	48.4	US-72 W/ US-231 S

Region 2 would potentially generate 66,442 tons of recyclable material annually, based on 691 pounds per household per year. Using the planning recovery figure of 525 pounds per household per year yields 50,505 tons per year of recovery that must be processed.

MRF designers plan on utilization of 26 days per month, two shifts per day, 6.5 working hours per shift.²⁸ Based on this formula, the capacity rate of the MRF needed is 12.5 tons per hour.

The current reported capacity of the Huntsville Recycling Center is 18,000 tons per year. The facility would need to grow to almost three times its existing capacity to manage the projected regional tonnage. Republic Services will need to be assured that the facility can depend on the projected recovered tonnage in order for the to invest in this additional capacity. The State of Alabama would work with the local government agencies on interlocal agreements to ensure the availability of the tonnage, assist these communities in procuring the necessary collection and transportation equipment, and then work with Republic Services to determine other

²⁸ Michael Timpane

actions that the State and its communities can do to guarantee the delivery of sufficient material.

Region 3: Decatur

Region 3 includes five counties with a total population of 350,225. The region includes four curbside recycling programs, in Athens, Cullman, Decatur, and Hartselle. The remainder of the population is served by drop-off centers. The processing hub would be located in Trinity, Morgan County, at the existing City of Decatur Recycling Center. This facility was chosen because the state has invested over \$170,000 in updating this MRF to single-stream. It already processes the material from the City of Athens and the City of Decatur.

The counties of Morgan and Winston would aggregate recyclables at their solid waste transfer stations for shipment to the Decatur MRF. Limestone County would utilize the existing Athens/Limestone Recycling Center as its aggregation and shipping location, and Cullman County would work with JCR Recycling, an existing private recycler that currently processes material from the City of Cullman. Lawrence County has neither type of facility, and would need to develop a centralized public drop-off center to use for aggregation and transport. Table 19 summarizes the logistics for Region 3.

TABLE 19: REGION 3

Hub Destination: City of Decatur Recycling Center			
Counties	Transfer Points	Distance to Hub, Miles	Highways
Morgan	City of Hartselle Transfer Station	19.2	US-31 N / AL-67
Limestone	Athens/Limestone Recycling Ctr	22.7	US-31 S
Cullman	JCR Recycling	45.8	US-65 N / US-72 Alt W
Lawrence	TBD		
Winston	County SW Transfer Station	60.9	AL-33

Region 3 would potentially generate 46,517 tons of recyclable material annually, based on 691 pounds per household per year. Using the planning recovery figure of 525 pounds per household per year yields 35,360 tons per year of recovery that must be processed.

MRF designers plan on utilization of 26 days per month, two shifts per day, 6.5 working hours per shift.²⁹ Based on this formula, the capacity rate of the MRF needed is 8.7 tons per hour.

The current reported capacity of the City of Decatur Recycling Center is 3,000 tons per year. The facility would need to grow to more than 10 times its existing capacity

²⁹ Eileen Berenyi, Governmental Advisory Associates 2008 Solid Waste Facilities Yearbook, <https://governmentaladvisory.com/publications/> and Michael Timpane, conversations.

to manage the projected regional tonnage. Such an investment is beyond the ability of any one local government agency, and MRFs this size are more efficiently operated by the private sector. The State of Alabama would work with the local government agencies on interlocal agreements to ensure the availability of the tonnage, assist these communities in procuring the necessary collection and transportation equipment, and then recruit a private sector operator for this large regional MRF. It may be necessary to recruit JCR Recycling in Cullman as an adjunct processor if the necessary capacity is not practical at the site of the City of Decatur's current MRF.

Region 4: Birmingham

Region 4 includes fifteen counties with a total population of 1,597,013. It is the largest region by population and includes the most densely populated region in the state, Birmingham and its surrounding communities. The region includes 45 curbside recycling programs, serving a total population of 900,426 people, 56 percent of the region's population. The remainder of the population is served by drop-off centers. The processing hub would be located in Birmingham, at Birmingham Recycling and Recovery, BRR, a private single-stream MRF that is currently the largest processing facility in the state. The Alabama Environmental Council (AEC) also operates a multi-material drop-off center in Birmingham that would continue to operate, and would serve as a transfer point for recyclables to BRR as needed.

Ten of the counties in Region 4 operate solid waste transfer stations that would serve as aggregation and processing centers for delivery to the central MRF hub. Additionally, the Calhoun County Recycling Center, City of Gadsden Recycling Center, and Fort Payne Recycling Center would serve as drop-off convenience centers for the public and aggregation and shipping points to the MRF hub. The curbside material from each municipality would be delivered to these intermediate locations, unless the municipality was close enough to route curbside trucks directly to the MRF. The four counties that have no transfer infrastructure, Shelby, St. Clair, Cleburne and Cherokee would need to establish drop-off convenience centers for their residents that could also serve as transfer locations for recyclables.

Table 20 summarizes the logistics for Region 4.

TABLE 20: REGION 4

Hub Destination: Birmingham Recycling & Recovery			
Counties	Transfer Points	Distance to Hub, Miles	Highways
Marion	Little Creek Transfer Station	79.5	I-22
Walker	Walker County Solid Waste	42.5	I-22
Jefferson	John's Road Transfer Station	19.1	I-20 E / I-59 N
	Alabama Environmental Council (AEC)	0.5	Local Roads
Perry	Arrowhead Trans-Load Station	96.7	I-20 E / I-59 N
Bibb	Bibb County Solid Waste Transfer Station	51.7	AL-5 N & I-20 E/I-59 N
Chilton	Chilton Co. Transfer Station	50.5	I-65 N
Shelby	TBD		
Talladega	Talladega Transfer Station	42.5	I-20 W
Saint Clair	TBD		
Blount	Blount County Transfer Station	35.6	I-65 S
Cleburne	TBD		
Calhoun	Calhoun County Transfer Station	60.4	I-20 W
	Calhoun County Recycling Center	61.5	I-20 W
Etowah	City of Gadsden Transfer Station	63.1	I-59 S
	City of Gadsden Recycling Center	59.6	I-59 S
Cherokee	TBD		
Dekalb	Ft. Payne Recycling Center	93.2	I-59 S

Region 4 would generate the largest quantities of recyclables of any of the eight regions due to the population density of the region. Potentially, 212,118 tons of recyclable material would be generated annually, based on 691 pounds per household per year. Using the planning recovery figure of 525 pounds per household per year yields 161,240 tons per year of recovery that must be processed.

MRF designers plan on utilization of 26 days per month, two shifts per day, 6.5 working hours per shift.³⁰ Based on this formula, the capacity rate of the MRF needed is about 40 tons per hour.

The current reported capacity of the BRR MRF is 19,200 tons per year, making it the largest MRF in the state. The facility would need to grow to over 8 times its existing capacity to manage the projected regional tonnage. The size of this MRF is comparable to the Republic Services facility in Ft. Worth, Texas, constructed in 2013.³¹

³⁰ Eileen Berenyi, Michael Timpane

³¹ Recycling Today, "Republic Services Opens MRF in Texas", September 2013. <http://waste360.com/sorting-technologies/sort-order>

The cost of building and operating a MRF that size is difficult to estimate without a detailed feasibility study that includes an assessment of the actual capacities of the existing facility that would serve as the foundation for expansion. Such a feasibility study is beyond the scope of this report, and cost estimates reported by MRF companies in the trade press are difficult to interpret, as some may include land costs, some may not, and some may be retrofits of existing facilities while others are brand new.

Republic did not announce costs for the Ft. Worth MRF in public documents, but they did report costs for a 30 ton per hour Jacksonville, Florida single-stream MRF that began operation in 2012 as \$6.5 million to construct, excluding the cost of land.³² The largest single-stream MRF in the country, Republic's 70 ton per hour facility in Las Vegas, reportedly cost \$35 million to build.³³ Other studies have estimated the total capital cost, including 5 acres of land, a 50,000 square foot building, and equipment, for a 25 ton per hour, 250 ton per day, MRF at \$27.8 million in 2011 dollars. Operations and maintenance costs were estimated by this report at \$47 per ton of capacity, and a replacement fund of \$1.2 million per year for the 20 years of facility operation was recommended.³⁴

In summary, expanding BRR or building a new facility to manage the potential recyclables from Region 4 is possible and similar size facilities have been built. However, this is a complex and expensive undertaking that is best handled by a private sector firm with MRF experience.

Region 5: Tuscaloosa

Region 5 includes nine counties with a total population of 325,333. The counties are mostly rural, and the region includes only three curbside recycling programs, in Tuscaloosa, Northport and Demopolis. The remainder of the population is served by drop-off centers. The processing hub would be located in Tuscaloosa, at the existing City of Tuscaloosa Recycling Center. This facility was chosen because the state has invested over \$1.0 million of grant funding in this facility, which already processes the curbside material from the City of Tuscaloosa.

Marengo County operates a solid waste transfer stations that would aggregate recyclables and ship to the Tuscaloosa MRF. Pickens County has a recycling processing center which could be used for this purpose. The remaining counties would need to identify, or construct, drop-off recycling centers that could serve the rural residents and also act to aggregate and transfer recyclables.

³² Waste360, July 6, 2012. <http://waste360.com/sorting-technologies/sort-order>

³³ David Bodamer, "Republic's Massive Las Vegas Facility Debuts", Waste360, November 12, 2015. <http://waste360.com/mrfs/republic-s-massive-las-vegas-mrf-debuts>

³⁴ GBB, Inc. Materials Recovery Facility Feasibility Report, City of Tucson Environmental Services, November 2008.

Table 21 summarizes the logistics for Region 5.

TABLE 21: REGION 5

Hub Destination: Tuscaloosa Recycling Center			
Counties	Transfer Points	Distance to Hub, Miles	Highways
Lamar	Waste Management	63.8	AL-18 E and AL-171 S
	Northwest Alabama	69.7	AL-171 S
Fayette	TBD		
Pickens	Pickens County Recycling Ctr	N/A	
Tuscaloosa	TBD		
Sumter	TBD		
Greene	TBD		
Hale	TBD		
Choctaw	TBD		
Marengo	ADS- Linden Transfer Station	69.4	AL-69 N

Region 5 would potentially generate 43,211 tons of recyclable material annually, based on 691 pounds per household per year. Using the planning recovery figure of 525 pounds per household per year yields 32,847 tons per year of recovery that must be processed. The necessary MRF capacity for processing would be 8.1 tons per hour.

The current reported capacity of the City of Tuscaloosa Recycling Center is 2,268 tons per year, or just over a half ton per hour. The facility would need to grow to more than 14 times its existing capacity to manage the projected regional tonnage. Such an investment is beyond the ability of any one local government agency, and MRFs this size are more efficiently operated by the private sector. The State of Alabama would work with the local government agencies on interlocal agreements to ensure the availability of the tonnage, assist these communities in procuring the necessary collection and transportation equipment, and then recruit a private sector operator for this large regional MRF.

Region 6: Montgomery

Region 6 includes 28 counties with a total population of 1,071,872, making it the largest region in land area and including the capitol city Montgomery. The region includes 24 curbside recycling programs, serving a total population of 530,300 people, 49 percent of the region’s population. The remainder of the population is served by drop-off centers.

The processing hub would be located in Montgomery. The now closed Infinitus Renewable Energy Park (iREP) facility would be the logical place to locate a large, regional MRF as it already has the capacity to manage the expected amount of material. Constructed in 2013, operational in 2014, and shuttered in October of 2015, the \$35 million, 82,000 square foot facility was originally designed to sort all municipal solid waste from Montgomery households and businesses as well as material from the surrounding area. Its reported capacity was 225,000 tons per year

of mixed municipal solid waste, which would be separated into marketable commodities by its advanced mixed materials sorting system.³⁵

Eight of the counties in Region 6 operate solid waste transfer stations that would serve as aggregation and processing centers for delivery to the central MRF hub. Publicly owned and operated recycling centers in the cities of Andalusia, Dothan, Troy, and Alexander and the counties of Coffee and Clay would also aggregate recyclables from both curbside and drop-off collection for shipment to the MRF hub. It is also expected that B&L Recycling and the Elmore Correctional Facilities would be able to deliver material to the MRF hub. The remaining counties that have no transfer infrastructure would need to establish drop-off convenience centers for their residents that could also serve as transfer locations for recyclables.

³⁵ Infinitus Energy. “Revolutionary Materials Recovery Facility Underway in Montgomery”, August 19, 2013. <http://infinitus-energy.com/infinitus-energy-brings-revolutionary-materials-recovery-facility-to-montgomery/>

Table 22 summarizes the logistics for Region 6.

TABLE 22: REGION 6

Hub Destination: Montgomery TBD			
Counties	Transfer Points	Distance to Hub, Miles	Highways
Washington	TBD		
Clarke	TBD		
Escambia	TBD		
Conecuh	TBD		
Monroe	TBD		
Wilcox	Wilcox County Transfer Station	74.9	AL-21 N
Butler	BFI Waste Services, LLC	45.8	I-65 N
Covington	City of Andalusia Recycling Center	95	AL-55 N and I-65 N
	B & L Recycling	86.4	US-331 N
Dallas	Advanced Disposal Service-Selma Transfer Station	50	US-80 E
Lowndes	TBD		
Crenshaw	TBD		
Coffee	Coffee County Material Recovery Program	79.6	US-231 N
Geneva	TBD		
Houston	City of Dothan Recycling Center	112	US-231 N
Dale	Dale County Transfer Station	93.1	US-231 N
	Waste Management	105	US-231 N
Pike	City of Troy Recycling Center	57.6	US-231 N
Montgomery	Central Alabama Transfer Station	8.6	Local Roads
	Montgomery Transfer Station	4.9	AL-152 W
	Elmore Correctional Facility	15.9	Local Roads
Autauga	TBD		
Elmore	TBD		
Macon	TBD		
Bullock	TBD		
Barbour	TBD		
Henry	Henry County Transfer Station	103	AL-10 W and US-231 N
Coosa	TBD		
Tallapoosa	Alexander City Recycling Center	50.6	AL-259 S and AL-9 S
Chambers	TBD		
Randolph	Randolph County Transfer Station	95.5	AL-22 W
	A-G-L Solid Waste Transfer Station		
Clay		82.8	AL-9 S
	Clay County Recycling Center	80.4	AL-9 S

Region 6 would potentially generate 142,368 tons of recyclable material annually, based on 691 pounds per household per year. Using the planning recovery figure of 525 pounds per household per year yields 108,220 tons per year of recovery that must be processed. The necessary MRF capacity for processing would be approximately 27 tons per hour.

The reported operating capacity of the iREP facility was 225,000 tons per year, and considering both the facility size and capacity it is more than adequate to handle the recyclables from the entire Region 6 and even more, if MRF hubs in adjacent regions were unable to reach their necessary size or capacity. The equipment installed in the facility was intended to sort solid waste and separate out marketable commodities, a more difficult job than processing single-stream recyclables, so it should be adequate to the task. If the equipment is sold and removed from the site, a MRF operator could be recruited to bring in another processing system if offered the incentive of operating in the existing building.

The City of Montgomery intended to create a world-class recycling system with their arrangement with IREP. Due to circumstances beyond their control, the mixed waste processing concept was unsuccessful. However, the City can still meet the goal of being the center of the State's engine of recycling growth by committing to recruit a single-stream processor to the City and encourage the growth of single-stream recycling collection in Montgomery and the entire region.

Region 7: Mobile

Region 7 includes two counties, Mobile and Baldwin, with a total population of 619,104. Baldwin County is currently home to four curbside recycling programs and operates a recycling processing center. Mobile County has no curbside programs, but does operate a small processing center in partnership with Easter Seals. Another smaller facility in West Mobile County functions as a drop-off center for the community.

The region would expand to include a total of 13 curbside recycling programs, serving a population of 340,985, about 55 percent of the region's population. The rural areas of the two counties area would be served by the existing drop-off centers.

Baldwin County's recycling center would aggregate recyclables and ship to the hub MRF. The City of Foley also has a recycling processing center which could be used for this purpose. Southern and eastern Baldwin County would need to identify or construct facilities for the aggregation and transportation of recyclables to the hub MRF. Additional capacity would also be needed in northern and southern Mobile County. The logistics for Region 7 are summarized in Table 23.

TABLE 23: REGION 7

Hub Destination: Mobile TBD			
Counties	Transfer Points	Distance to Hub, Miles	Highways
Mobile	Mobile Recycling Center		
Baldwin	Baldwin County Recycling Center	43.8	I-10 W
	Town of Fairhope Recycling Center	38.5	I-10 W

Region 7 would potentially generate 82,230 tons of recyclable material annually, based on 691 pounds per household per year. Using the planning recovery figure of 525 pounds per household per year yields 62,507 tons per year of recovery that must be processed. The necessary MRF capacity for processing would be approximately 15 tons per hour.

The current reported capacity of the Mobile County Recycling Center is 1,320 tons per year, much too small to manage the project amount of material. One option would be to expand and improve the facility to the necessary size and capacity. Without a site visit to the Center, the authors of this report cannot make a recommendation as to the feasibility of this option.

Three other options for this region are to utilize the existing private recycling processor in Loxley, Tarpon Paper, to encourage the communities in this region to ship their recyclables to facilities in Florida, or to recruit a private MRF operator to site a new facility in the region by working with the local governments in this region to guarantee the tonnage.

The authors of this report were unable to gather information regarding the capacity or intentions of Tarpon Paper. Escambia County, Florida, adjacent to Baldwin County, anticipates the opening in September, 2016 of a new MRF at the Perdido Landfill, just off of I-10 at the two states border. This \$10 million facility will have the capacity to handle approximately 40,000 tons per year. It will serve approximately 95,000 existing customers of the Authority when it opens.³⁶ While this facility will not be able to manage Region 7's entire projected material recovery, it could be helpful in the interim while the system is being developed. For planning purposes, the hub MRF is identified in an undetermined location in or near the City of Mobile.

Region 8: Columbus, GA

Region 8 includes two counties, Lee and Russell, with a total population of 216,653. Two curbside programs operate in the cities of Opelika and Auburn. Lee County operates a recycling processing center. Russell County does not have any known recycling infrastructure.

³⁶ Hana Frenette. "ECUA Facility Nears Completion", Pensacola News-Journal, July 2, 2016.

The region would add two more curbside recycling programs in Russell County, to serve a total curbside population of 132,220, about 61 percent of the region’s population.

Recyclables from Region 8 would be sent out of state to the Pratt Industries single-stream MRF in Columbus, Georgia. This facility, which opened in late 2013, has a capacity of 20 tons per hour in a 54,000 square foot facility.³⁷ The City of Opelika is currently sending their materials to Pratt.

Recyclables would be aggregated and shipped to the Pratt MRF from solid waste transfer stations in Lee and Russell Counties, as well as from the Lee County Recycling Center. The logistics of Region 8 are summarized in Table 24.

TABLE 24: REGION 8

Hub Destination: Pratt Industries, Columbus GA			
Counties	Transfer Points	Distance to Hub, Miles	Highways
Lee	East Alabama Transfer Station	42	US-280 E and US-80E
Lee	Lee County Recycling Center	41.9	US-280 E and US-80E
Russell	Phenix City Transfer Station	13.1	Local roads
	Pine Hollow Transfer Station	16.7	Local roads

Region 8 would potentially generate 28,776 tons of recyclable material annually, based on 691 pounds per household per year. Using the planning recovery figure of 525 pounds per household per year yields 21,874 tons per year of recovery that must be processed. The necessary MRF capacity for processing would be approximately 5.4 tons per hour. The Pratt MRF in Columbus has the capacity to manage this tonnage.

³⁷ “Pratt Opens New MRF”, Recycling Today, December 16, 2013.
<http://www.recyclingtoday.com/article/pratt-opens-columbus-georgia-mrf/>

Best Practice: Cart-Based Single-Stream Curbside Recycling

The State of Alabama should encourage and incentivize local communities of over 5,000 populations to provide cart-based single stream recycling for all materials except glass containers, and should encourage and incentivize curbside communities to promote drop-off recycling centers for glass containers.

Cart-based single stream recycling is already the predominant mode of household service in Alabama. Only thirteen of the 52 curbside programs do not use carts. This is primarily due to Republic Services, which provides cart-based curbside recycling to a large number of communities in the Birmingham and Huntsville MSAs. Several publicly operated programs have also adopted carts, purchased with ADEM grants. Material from the communities in the Birmingham region is sorted at Birmingham Recycling and Recovery, and from the Huntsville region at the Huntsville Solid Waste Authority MRF operated by Republic Services. Other single-stream MRFs are operated by the City of Decatur and the City of Florence. Single-stream recyclables collected by the City of Dothan and the City of Opelika are delivered to the Pratt MRF in Columbus, Georgia.

The first curbside recycling programs in the early 1990's relied upon "curb sorts," where materials were sorted by collection staff at the curb as the material was placed into separated sections of the route truck. Typically, residents used two recycling bins – one for paper and one for containers – in a "dual stream" system. As soon as one section was filled, the truck had to return to the process center to unload, even though several of the material sections were well below capacity. This inefficiency was expensive and led to the development of single stream practice for curbside programs. A side benefit from the conversion was a significant increase in participation due to the greater ease with which the homeowner could recycle.

Using rolling carts, typically 95-gallons in size, allows more material to be collected per stop. Because curbside programs are not required to report their collection tonnage to ADEM, Alabama specific data is not available to show that cart-based single stream recycling results in larger collection volumes. However, data is available from industry groups, state governments and individual communities that support the connection between cart-based single-stream recycling and maximum material recovery.

The state of North Carolina began a carts grant program for municipalities in 2007, and credits widespread cart adoption for a statewide increase in curbside collected material of more than 100,000 tons between FY 2005-06 and FY 2011-12. Overall, communities that received cart grants increased collected tonnage by an average of 73 percent³⁸.

The City of Atlanta, Georgia distributed 65,000 95-gallon recycling carts to residents in four months in 2014. The rapid roll-out made it possible to document the increase

³⁸ Mouw, Taylor and Fitzpatrick, "Cartpe Diem". *Resource Recycling*, November 2013

in recycling immediately after the distribution. The City found that overall recycling tonnage increased 55 percent over the year before, prior to carts³⁹

Florence, Alabama distributed 65-gallon recycling carts to all its residents in 2015, made possible by an ADEM grant and with support from The Recycling Partnership, which included grant funding and support for outreach and logistics. City officials reported that while they thought the entire city was included in the recycling program, after rolling out the carts they realized entire neighborhoods had not been participating. The participation rate increased by 30 percent over three months, and the increased tonnage temporarily overwhelmed the City's processing center.⁴⁰

In addition to the benefits of increased tonnage and participation, industry data shows that carts also help cities in other ways:

- Rolling carts benefit residents because they are easier to roll to the curb,
- Carts with lids decrease blowing litter in neighborhoods
- Larger cart capacities enable cost savings via every other week recycling collection and greater route efficiency
- Carts may be serviced by tippers installed on semi-automated rear-loading trucks, or by fully-automated trucks, reducing on-the-job injuries to workers
- Residents can store recyclables outside, since the carts have lids, and not take up space in their garage or kitchen.

A total of 63 additional cities and towns in Alabama have populations greater than 5,000 and are candidates for curbside recycling service. This will bring the total number of curbside communities in Alabama to 115 and serve 54 percent of the State's population. Table 25 summarizes the existing and projected curbside recycling communities. A complete list is included in the Appendix.

The number of single-family households in these communities totals 361,573, per U.S. Census data. Section 1 of this report used data from three reliable residential waste stream composition studies to estimate that 28.12% of Alabama's residential waste stream is recyclable, which comprises 691 pounds per household annual. Using these figures, an estimated 124,923 additional tons of recyclables could be recovered from these new curbside communities in Alabama. The savings in landfill tipping fees alone from recovering these materials instead of disposing of them is over \$5.4 million.

The Recycling Partnership provides an excellent document entitled "A Guide to Implementing a Cart-Based Recycling Program".⁴¹ The Guide provides detailed,

³⁹ The Recycling Partnership, Case Studies <http://recyclingpartnership.org/city-of-atlanta-georgia/>

⁴⁰ The Recycling Partnership, <http://tools.recyclingpartnership.org/lessons-learned/>

⁴¹ The Recycling Partnership, Carts Guide, http://tools.recyclingpartnership.org/wp-content/uploads/2015/09/digital_carts_guide.pdf

real-world guidance on every aspect of establishing high-performing cart-based collection. ADEM should work with The Recycling Partnership to ensure that Alabama communities are educated in using this tool. A series of workshops, supplemented with webinars covering this content could be required of each local government that receives an ADEM grant for carts.

TABLE 25
ALABAMA CURBSIDE PROGRAMS – EXISTING AND PROPOSED

Number of Existing Curbside Recycling Programs	52	Population Currently Served	1,517,390
Number of Proposed Curbside Recycling Programs	62	New Population Served	1,127,099
Total Number of Curbside Programs Anticipated	114	Total Population to be Served	2,644,489
Percent of State Population to be Served			54%

Best Practice: Comprehensive Drop-off Recycling

The State of Alabama should encourage and incentivize curbside communities to provide drop-off recycling access for their multi-family populations, and rural communities for their entire populations. Drop-off centers should establish single-stream collection for the same suite of materials as curbside programs, should also accept glass containers in separate containers, and should provide all residents with recycling opportunities for materials such as appliances, scrap metals, lead-acid and rechargeable batteries, used motor oil, oil filters and tires.

A significant number of Alabama counties and communities are predominately rural and sparsely populated. While it is important to provide recycling opportunities for rural residents, curbside recycling is often not practical or affordable. The State should encourage local governments in these areas to establish recycling drop-off centers for residents. Residents of municipalities that offer curbside recycling of paper and packaging should also have access to drop-off centers for additional materials as specified below. Drop-off centers should meet the following criteria:

- Collect common recyclables, except glass, in single-stream restricted-opening roll-off containers and compacted for efficient transportation.
- Paired with solid waste transfer or disposal sites that act as locations to transfer recyclables to hub processors;
- Alternatively established at existing recycling processing centers
- Be staffed, open to the public during specific hours of the day, and secured when closed.
- Collect glass in separate, dedicated containers chosen to fit the needs of the market.
- Provide the opportunity to collect and recycle special items that are not suitable for curbside collection, including used appliances and scrap metals, lead-acid vehicle batteries, electronics such as computers and cell phones along with rechargeable batteries, and motor oil and filters.

Counties that currently have neither a solid waste transfer station nor an existing recycling center would need to identify and develop one or more locations that could serve as both these community drop-off convenience centers and locations for aggregation and shipping of curbside collected materials from their county programs, if such exist, to the central MRF hub. The special items could be marketed directly from the drop-off centers or transported to the MRF hub, depending on where the markets were located. ADEM should assist with the marketing of these materials by identifying markets, but also establishing statewide contracts as necessary to allow all counties equal access to markets.

Collection of materials in a single stream fashion at drop-off centers achieves the same results as in curbside programs - participation increases and collection costs decline.

Source separated convenience centers use individual roll-off or other handling equipment dedicated to each material type collected. When a specific container

approaches capacity, the convenience center attendant contacts the driver dispatch for a pick up, regardless of the time of day. Trucks and drivers must be available all day. When the center is converted to single stream, the attendant has several containers available to single stream recycling. By directing traffic to containers with capacity with traffic cones or signage, the attendant is able to fill containers sequentially. Dispatch can direct trucks to haul full containers once a day, with trucks running until the full containers are collected. The trucks and drivers are then freed to perform other duties for the remainder of the day.

Participation at convenience centers increases because recycling becomes much easier for residents with single stream collection. The time spent at the convenience center is much shorter, as the recycler now just dumps mixed recycling into a single roll-off container. Participants universally report that they prefer the simpler method. As convenience center patrons are exposed to the elements, shortening recycling time removes an impediment to participation. Often bees are attracted to the beverage containers at convenience centers. Again conversion to single stream reduces the patrons' exposure time to the experience, positively influencing participation.

With the conversion, some counties will be able to reduce the number of trucks dedicated to the recycling program, reaping a cost savings. Future convenience centers may not need to be designed with as many roll-off containers, reducing capital costs.

Moore County, North Carolina made the conversion to single stream collection at its convenience centers in fiscal year 2013. Moore County operates seven convenience centers to serve the extra-municipal households in the county. Prior to the conversion to single stream at the convenience centers, homeowners were responsible for separating their recycling materials into multiple different material types. The county was collecting 1,035 tons of recycling annually. After the conversion the collection increased 75% to 1,809 tons of recycling annually. Additionally, the county experienced significant collection cost savings. Annual cost for recycling material collection dropped from \$144,573 in FY 2012 to \$53,775 in FY 2014.

The state of South Carolina, with a population almost exactly the same as Alabama's but a much smaller land area, has 580 recycling drop-off centers. Data on the history and performance of these sites were obtained from the South Carolina Annual Solid Waste Report for Fiscal Year 2015⁴² and email correspondence with officials at the S.C. Department of Health and Environmental Control (DHEC).

According to DHEC, the drop-off system was established in the early 1990's to replace unstaffed "green box" sites for disposal of solid waste in rural areas. The goal

⁴² South Carolina DHEC
<http://www.scdhec.gov/HomeAndEnvironment/Recycling/DataReports/>

was to provide staffed convenience centers for solid waste within five miles of all residences. With funding for used motor oil collection provided for by South Carolina’s 1991 Solid Waste Management and Policy Act, these drop-off convenience centers also gave rural residents locations to recycle do-it-yourself motor oil as well as household garbage. The state was then able to leverage additional solid waste funding for grants to enable counties to build comprehensive convenience centers to take trash, recycling and oil related materials.

These sites, along with an additional 311 sites provided by auto parts stores for lead-acid batteries and used motor oil, enabled the recycling of the following amounts of residentially generated materials in fiscal year 2015 shown in Table 26.

TABLE 26
ALTERNATIVE MATERIALS RECYCLED IN SOUTH CAROLINA
VIA DROP-OFFS

Recyclable Material	Amount Recycled via S.C. Drop-offs in FY2015
Appliances	10,227 tons
Electronics	8,392 tons
Lead-Acid Batteries	8,014 tons
Tires	34,668 tons
Used Motor Oil	2,490 tons
Rechargeable Batteries	16 tons

Alabama should dedicate a portion of its recycling grant funding to the establishment of a drop-off convenience center network similar to South Carolina’s. In some counties, the existing recyclables processing center, which is infrastructure already developed by ADEM grants, can be used for this purpose. Two examples are outlined below. The information about these drop-off centers was obtained via internet research, email correspondence and interviews with local recycling officials.

Athens-Limestone County Recycling Center

The Athens-Limestone County Recycling Center is operated by Keep Athens-Limestone Beautiful. Their main recycling drop-off center is open Monday – Friday, 7am-3:30pm. Outside of this main recycling center, they have bins that are available 24/7 to the general public.

This main recycling drop-off center collects all the traditional recyclable materials as well as some harder to recycle items such as cooking oils, electronics, and motor oil. Fourteen satellite community collection centers are located mostly at area schools and churches.

Keep Athens-Limestone Beautiful also provides valuable community education, including visiting all schools in the area annually, participating in outreach events such as Earth Day, sending out newsletters, and maintaining a website.

City of Tuscaloosa Recycling Center

Tuscaloosa's drop-off program has been operating since 2000. The main facility takes in and processes recyclables from sixteen unstaffed satellite centers in the Tuscaloosa area. All of them accept standard household recyclables, and nine of them also accept glass. Both residential households and commercial generators use the centers. Tuscaloosa County residents also use them.

Their main recycling center will take hard to recycle items like Christmas trees, electronics, etc. Sometimes they have special holiday collections at this larger center for higher volumes of material.

The high utilization rate is reflected in the need to service each center seven days per week. Many apartment complexes in the area house university students, and these multi-family structures don't have access to curbside recycling.

The main recycling center is a new facility, with meeting rooms that are offered to the community at no charge, but with the requirement that groups listen to a recycling presentation. The City offers environmental education at this facility and gives tours of the center.

Best Practice: Common Suite of Materials

The State of Alabama, in consultation with processors and end-markets, should develop a common suite of recyclable materials. The state should encourage and incentivize local governments to adopt all of these materials in their recycling program. The state should also develop toolkit of consistent material descriptions and terms for these materials, using available industry sources, and disseminate these for use in local recycling promotional and educational materials.

Successful recycling programs are dependent on consistently high levels of participation by residents, efficient sorting and processing of materials, and strong market demand. To optimize these factors and the state's overall recycling program, a common suite of residential household materials to be collected for recycling should be identified and defined by the state, and local communities should be required to adopt all of these materials in their recycling programs. The state should provide assurance that processing capacity and markets exist for all of these materials, and should provide guidance to local communities in making sure that service contracts allow for the addition of new materials as markets expand, and in fostering continual communication with processors and markets to ensure that all marketable materials are being recovered.

The state should immediately begin conversations with processors and markets to determine a list of universally accepted recyclables. The Recycling Partnership has developed an "Acceptable Materials Worksheet" that can be used as a foundation for these discussions.

A suggested starter list should include the following materials.

- Aluminum cans, including beverage cans, food cans and pet food cans;
- Steel cans, including empty aerosol cans;
- All plastic containers, including tubs, cups, and thermoforms
- Bulky rigid plastics such as cat litter buckets
- Corrugated cardboard
- All residential paper
- Aseptic and gable-top cartons
- Glass bottles and jars

Glass and aseptic/gable-top cartons are two materials which are under-collected in Alabama. Each is discussed below.

Glass

Due to a number of difficulties in recovering and managing glass, most communities in Alabama do not include glass in their list of recyclables. It is included in three curbside programs, and one is discontinuing that service in the fall of 2016. Table 27 presents a summary of the Alabama programs that do collect glass.

TABLE 27
ALABAMA COMMUNITIES COLLECTING GLASS CONTAINERS

Alabama Communities Recycling Glass Containers				
Program	Operational Details	Market	Economics	Recovery
Auburn City	Curbside sort, no green glass	Strategic Materials via local processor	Unknown	Unknown
West Mobile Recycling Center	Drop-off collection, color sorted, two REM crushers, store in gaylords	Strategic Materials	\$30/day for labor to crush, \$600 for freight, \$500 in revenue	96.2 tons in 2015, app. 5 loads
Tuscaloosa Recycling Center	Drop-off only, not in curbside. One Andela crusher. Make glass mulch and glass sand, store in outdoor bunkers	Local City projects: crusher run, road base, road bed aggregate, water filtration, landscaping	Cost of electricity for crusher and transport fuel unknown. If substituted for pea gravel at \$42.50 per ton, savings of \$2,125 in 2015	50 tons in 2015
City of Daphne	One crusher, Komplet M2000. Will discontinue glass at curbside in fall of 2016.	Local public works projects	Unknown	45 tons in 2015
Town of Fairhope	Collect curbside. Crush with skid steer, sell mixed colors.	Strategic Materials picks up 45,000 lbs loads	Pay half of freight to Atlanta, \$240 per load, for 23 loads = \$5,616	468 tons in 2015, about 23 loads
Alabama Environmental Council	Accepts mixed color glass from public. Charges a fee of \$3 for a 18-gallon bin or \$5 for a 55-gallon drum. Have a refurbished Andela crusher.			

Glass recycling is increasingly recognized as a difficult business proposition for recycling processors, particularly single-stream MRFs. Many MRFs have outdated glass-breaking systems, which allow small pieces or shards of glass to contaminate other material streams. A significant portion of incoming glass from curbside programs that use automated collection and compaction is already broken when received at MRFs. Recovered glass in many MRFs is poor quality, contaminated by small, heavy items that act like glass in the sortation system, but are actually contaminants, such as metal and plastic bottle caps, coins, plastic prescription bottles, plastic utensils, and others. The contamination forces glass markets to reduce prices for MRF-generated glass, and the low price along with high shipping costs have driven MRFs to eliminate glass from their facilities. Communities then stop collecting glass.

This is not a problem unique to Alabama. Recently the City of Greenville, South Carolina was forced to eliminate glass from their curbside program. Atlanta, Georgia discontinued curbside glass recycling in early 2016.

Even acknowledging the difficulties in collecting glass for recycling, it is a material that has been recycled since household recycling began almost 50 years ago. Many consumers prefer glass packaging, and it is still a commonly used packaging material. For these reasons, the authors of this report recommend that glass collection be offered to Alabama residents in a manner that makes it as convenient as possible for residents but still preserves the integrity and quality of the material for end use.

While this report recommends single-stream, cart based curbside collection as a best practice for cities and towns, it recommends that glass be instead directed to drop-off centers, where it can be kept separate from other materials, kept clean, and color-separated by the public if dictated by the end market. Alabama also has a unique opportunity to create a robust network of drop-off centers for the collection of glass bottles and jars. Separate containers should be provided for glass, with the degree of color separation dictated by the end use market for the glass.

By preserving the integrity and quality of the material, a statewide drop-off system for glass will yield the following benefits:

- Make Alabama recovered glass a sought-after material by the markets
- Provide leverage to Alabama communities in negotiating higher revenues and lower shipping costs
- Result in less contaminated curbside material, potentially saving on MRF equipment maintenance costs and boosting revenue for cleaner paper and plastic materials
- Allow communities to choose whether to ship glass to out of state markets, or to keep it local as a material substitute for gravel or filtration media in public works projects.

Aseptic and Gable-top cartons

Aseptic and gable-top cartons, which are often erroneously called “waxed cartons”, are increasingly substituting for glass and metal packaging. Since consumers were able to recycle their glass and metal predecessors, they are demanding recycling options for these containers. The Carton Council has developed operational and educational tools for recycling coordinators to use in adding these materials to their programs.

Aseptic, or shelf-stable, cartons, used for soups, broths, and sauces, are made of an average of 74% paper, 22% polyethylene film, and 4% aluminum. Refrigerated cartons, used for milk, non-dairy milk, and juices, are made of an average of 80% paper and 20% polyethylene. According to the Carton Council, paper mills view cartons as a valuable source of fiber because they offer high quality virgin, bleached long fiber, which can be used in several applications including tissue and toweling products, de-inked pulp and green building products such as wallboard. Currently

four mills in the U.S. along with others in Mexico and overseas actively seek out loads of recovered cartons from MRFs. The Carton Council can provide contacts with brokers to help communities and processors access these markets.

Alabama communities that accept aseptic and gable-top cartons for recycling are centered around Dothan and Birmingham. Carton recycling access is concentrated around the two processors known to handle cartons, Birmingham Recycling and Recovery in the state of Alabama and Pratt Industries in the state of Georgia. It is not known where Pratt markets this material. BRR markets it along with their mixed paper. Table 28 lists Alabama communities known to collect cartons for recycling.

This table shows that almost a million people in Alabama have access to recycling for aseptic and gable-top cartons, comprising about 20 percent of the population. Approximately 99,790 single-family households have curbside programs that include carton recycling. This is about 22 percent of the households with curbside recycling. Nationwide, about 57 percent of communities have access to carton recycling programs.

TABLE 28⁴³

Alabama Communities Recycling Aseptic and Gabletop Cartons								
City or Town	County	Population	Total Households	Recycling	Curbside Population	Curbside Households	Collector	Processor
Hoover	Jefferson	84,353	32,375	Curbside	60,565	23,245	Republic Svcs	BRR
Dothan	Houston	68,409	25,935	Curbside	60,679	23,004	City of Dothan	Pratt
Vestavia Hills	Jefferson	34,124	13,637	Drop-off	27,470	10,978	Republic Svcs	BRR
Alabaster	Shelby	31,545	10,416	Curbside	29,810	9,843	Advanced Disposal	BRR
Homewood	Jefferson	25,802	9,306	Curbside	17,133	6,179	Republic Svcs	BRR
Helena	Shelby	17,833	5,825	Curbside	17,780	5,808	Republic Svcs	BRR
Hueytown	Jefferson	15,815	6,008	Curbside	14,882	5,654	Republic Svcs	BRR
Fairfield	Jefferson	10,592	3,954	Curbside	9,003	569	Republic Svcs	BRR
Clay	Jefferson	9,700	3,724	Curbside	9,361	3,594	Republic Svcs	BRR
Arab	Marshall	8,284	3,335	Curbside	7,596	3,058	Republic Svcs	BRR
Tarrant	Jefferson	6,397	2,573	Curbside	6,071	2,442	Republic Svcs	BRR
Midfield	Jefferson	5,263	1,932	Curbside	5,168	1,897	Republic Svcs	BRR
Warrior	Jefferson	3,176	1,270	Curbside	3,017	1,207	Republic Svcs	BRR
Brighton	Jefferson	2,896	1,158	Curbside	2,751	1,100	Republic Svcs	BRR
Lipscomb	Jefferson	2,210	884	Curbside	2,100	840	Republic Svcs	BRR
Trafford	Jefferson	645	258	Curbside	613	245	Republic Svcs	BRR
West Jefferson	Jefferson	334	134	Curbside	317	127	Republic Svcs	BRR
Remainder of Jefferson County		459,060	182,184	Drop-off	-	-		AEC
Remainder of Shelby County		159,335	58,549	Drop-off	-	-		AEC
Remainder of Houston County		35,764	13,529	Drop-off	-	-	Unknown	Pratt
Totals		981,537	376,986		274,315	99,790		

⁴³ The Carton Council, <http://www.recyclecartons.com/?state=al>

Best Practice: Standardized Education and Outreach

The State of Alabama should develop a standardized recycling education and outreach program that establishes a theme and a “brand” for recycling in Alabama, and then provide specific tools to communities to enable them to adopt the brand and adapt the theme to their own situations.

An education and outreach program in support of community recycling is absolutely needed and should be required for all grant recipients. An abundance of tools is available from numerous sources to ensure that the educational program is effective. One of the most helpful tools that the State of Alabama could provide to communities and residents would be a state-of-the-art educational program, professionally created and reflecting current research on how to motivate residents and create behavior change.

ADEM and other stakeholders did create and disseminate a statewide educational campaign entitled “Recycling Works for Me”. This television and radio campaign highlighted recycling as a positive economic impact and job creator in Alabama. Funded by ADEM’s Recycling Fund, the public service announcements targeted local TV and radio stations with assistance from Alabama Broadcasters’ Association (ABA). The cities of Albertville, Boaz, Daphne, Florence, Troy, Tuscaloosa, the Alabama Environmental Council and the East Alabama Recycling Partnership (comprised of the cities of Auburn, Opelika, Lee County, and Auburn University) applied as cooperative partners for the ADEM Recycling Fund grant in spring 2013. The partners requested \$75,000 to air a statewide recycling campaign, and the grant was awarded in fall 2013. The Alabama Broadcasters Association (ABA) agreed to match the grant award 3:1, allowing for \$225,000 worth of airtime on regional television markets with specific local contact information to benefit all partners. The ABA also produced radio spots to run regionally. The partner cooperative cities and organizations worked with local industries and communities to develop and film the statewide campaign.

All partners were able to highlight the active recycling programs in their communities and provide local contact information to each PSA. The Alabama Recycling Coalition financed the production of the 15 second, 30 second, and 60 second television PSAs.

The “Recycling Works for Me” campaign followed the journey of recovered material through the multiple industries involved in the recycling process. The campaign emphasized the significant positive economic impact of the recycling industry in the state of Alabama, and projected additional added value if 10% more were able to be recovered. The PSAs ran in each Alabama TV and radio market from August 2014 to April 2015.

A number of other statewide and regional recycling educational campaigns are available as models to the State of Alabama. These include:

- The State of North Carolina RE3 program and Recycle More NC program;
- The State of South Carolina Recycle Guys program and Recycling Means Jobs program
- The State of Georgia “I Don’t Recycle” and “I’m Recycling in Georgia” programs
- The Recycling Partnership detailed guidance entitled “Communicating the Right Thing at the Right Time”, and many other tools, on their web site.

Dr. Wesley Schultz, a Professor of Psychology at California State University, is an acknowledged leader in applied research on behavior change. Recycling, ultimately, is a behavior, and residents must participate in their local program so that recovery is maximized, which makes the entire system efficient and cost effective.

A complete review of Dr. Schultz’s work is beyond the scope of this study, but several important learnings can be gained from his work and used to create effective recycling motivational campaigns:⁴⁴

- Information is generally not sufficient to create behavior change. While education and information increase knowledge, more knowledge does not result in behavior change. In other words, people may know that a community offers a curbside program, but still not participate.
- Awareness of the severity of an issue is also not in itself sufficient to cause behavior change. Emphasizing how big a problem is causes concern, but that concern is often not enough to change behavior. In fact, it may have a boomerang effect, leaving people with a feeling of helplessness, that their small effort won’t make any difference to a huge problem.
- Pledges and financial incentives can result in behavior change, with some cautions. Pledges can be effective if they involve groups, are very specific in terms of the action to be done, and have a defined time frame. Financial incentives can create excitement, but also expectations, and be difficult to sustain.
- The most effective way to change behavior is through social norming. Social norms are an individual’s beliefs about the common and accepted behavior in a specific situation. Normative beliefs are correlated with behavior, and can be changed to create behavior change.
- The application of social norming to recycling behavior is termed “Community-Based Social Marketing” or CBSM. CBSM is a five-step, data-driven process that effects behavior change by removing barriers to, and enhancing benefits of, the desired behaviors.⁴⁵

⁴⁴ Keep America Beautiful and Dr. P. Wesley Schultz, “Promoting Recycling Behavior” workshop at 2013 *Resource Recycling* Conference, Louisville, KY

⁴⁵ Community-Based Social Marketing, www.cbsm.com.

Each community's education and awareness program can be unique to them but be thematically consistent with other communities. In addition to the big picture of theme and brand, the State program can also be used to promote the common suite of materials, provide guidance on reducing contamination, and help communities understand and use CBSM.

Best Practice: Improved Data Gathering

The State of Alabama should improve its data reporting system for local governments, and ensure that it includes all entities that manage materials, including collectors and markets. The state should do this by convening these stakeholders in a structured design process that allows them to have input into the system, to ensure cooperation and understanding.

One can't manage what isn't measured. The research conducted for this report found that Alabama could improve the way it collects and manages recycling data.

ADEM requires handlers and processors of recovered materials to submit two reports to ADEM semi-annually through the Re-TRAC Connect system. For the periods January through June, and then July through December, these facilities are required to submit forms documenting their Recyclable Materials Received or Generated, and their Recyclable Materials Transported and Disposed.

The Materials Received or Generated asks for a breakdown of material from “registered facilities” and “non-registered facilities”. A list of material types is provided, and space is also provided for commingled materials and for additional materials to be written in.

The Materials Transported or Disposed asks for a breakdown of material to “Further Processors” or “End Markets”, provides a list of material types, and also asks for documentation of revenue received for each type of material.

ADEM calculated a waste reduction rate of 16.36% for 2015, based on the reports submitted by registered facilities reporting through Re-TRAC Connect. According to ADEM's data, an estimated rate of 27.71% would have been achieved if the total number of suspected facilities in the state that should be registered, were actually registered and reporting their data. The estimated rate would have been sufficient to exceed Alabama's waste reduction goal of 25%.

The calculated waste reduction rate includes all materials counted as municipal solid waste, with the addition of construction/demolition (C&D) and industrially generated and recycled materials. The entities reporting on RE-TRAC Connect are mostly private recyclers, with approximately 30 local governments, 4 universities and one not-for-profit on the list.⁴⁶

The research done for this report included interviews and email correspondence with managers and operators of recycling centers, to gain an understanding of where the reported materials originated (i.e. how much from curbside programs, from drop-offs, etc.). Contact was also made with ADEM regional recycling staff persons to obtain data from individual specific organizations.

⁴⁶ These estimates were derived from an examination of the entity names, and some names may not have been correctly interpreted.

It was determined from these interviews that ADEM does not require reporting from collectors or haulers, only from processors. Therefore, it is not possible to obtain a total amount recovered from residential curbside programs, and to isolate this from the amounts recovered from drop-off programs, commercial collection, special events, or other discrete sources of material recovery.

The authors of this report heard from several facility managers that they were confused in filling out these forms, and are unsure of what information ADEM really wants.

In order to improve data reporting and have confidence in the accuracy of the data, ADEM should reevaluate the current system to determine what modifications would yield better data. Questions to be asked could include:

1. What data is necessary to evaluate the performance of Alabama's recycling system?
2. Who has that data?
3. How can ADEM provide tools that ensure that these owners of the data will report it, will report it accurately, and will feel sufficiently comfortable with the data gathering process that they willingly and regularly participate?

Answering these questions on behalf of ADEM is beyond the scope of this report. The recommendation is that ADEM convene a series of workshops, or even design charrettes, involving key participants from all sectors involved in the recycling value chain. These stakeholders would include cities and counties, rural and urban areas, and active non-profit agencies engaged in recycling collection and community relationships as well as private companies that operate hauling, processing, and remanufacturing businesses.

Involving the stakeholders in answering the questions above and creating the data reporting system is the best way to ensure cooperation in using the system. A shared sense of ownership will result in better long-term feedback, closer relationships among all stakeholders, and a structure for continuous improvement. Again, other states and The Recycling Partnership offer models that can start discussion.

This study recommends that all grant recipients be required to report all recycling and waste management activity to ADEM from the time of the initial grant application and ongoing annually at a minimum if any grant is awarded.

Best Practice: Tools for Higher Performance

The State of Alabama should adopt certain programmatic strategies in support of the regional hub and spoke recycling system recommended in this report.

This report is recommending that the State of Alabama boldly go where no rural, southern state has gone before – essentially creating a statewide engine to extract recyclables from communities and accelerate their transformation into industrial raw materials. To be successful, the State will need all of the tested best practices tools available to build and operate this engine. Public programmatic strategies should be used as an important driver of this effort.

Certain public policies are divisive and inequitable, such as beverage container deposit (“bottle bills”), advance disposal fees, extended producer responsibility, and mandatory recycling. These are not recommended for Alabama.

However, certain equitable and incentive-based public initiatives have wide support in the recycling community because they are complementary to voluntary approaches and have been successful without causing undue disruption. Four program approaches in particular have relevance to Alabama’s situation:

- Universal Access to Recycling
- Disposal restrictions for certain post-consumer packaging materials
- Variable rate solid waste pricing, also known as “Pay as you Throw”
- Provision of recycling through hauler licensing

Some of information presented below was also the result of research conducted for the Carton Council. In particular, this Carton Council research developed the tools and data listed below in reference to variable rate solid waste pricing and hauler licensing. SERDC joins the Carton Council and its partners in supporting community-based tools to ensure the maximum performance of local recycling systems.

This report recommends that Alabama adopt the first two approaches at the state level, and enable/encourage local governments implement variable rate pricing and hauler licensing. These tools are intended to support and enable the hub-spoke recycling system so that it can perform at the highest level. This report does not suggest that public programs by themselves are sufficient to maximize material recovery in Alabama, but that it be used in coordination with the other recommendations in this report.

Universal Recycling Access

Universal access to recycling requires local governments, institutions, and commercial entities to provide residents or users access to recycling services if they provide trash services. For local governments, universal access means curbside collection for household trash as well as curbside collection for recyclables. This usually applies to contracts they would sign with private haulers as well as their own operations. Universal access may also require new construction, particularly multi-family dwellings, to provide space for recycling collection and storage

alongside space for trash. It may also apply to venues and commercial buildings, essentially reinforcing recycling behavior by allowing residents to “recycle everywhere”. Some examples of local governments that have universal access ordinances:

- Austin, Texas requires multi-family residential properties and commercial non-residential properties to provide recycling access for a minimum of five recyclable materials, to place recycling containers within 25 feet of all trash containers, to provide recycling capacity of at least 6.4 gallons per week to every multi-family residence, to submit and annual waste diversion plan, and to provide signage and education;⁴⁷
- Decatur, Georgia requires all multi-family properties with more than four units, that are not serviced with residential collection, to provide recycling on-site for a minimum of four designated materials.⁴⁸

While these examples are local rather than statewide, there are opportunities for state government to provide leadership in the promulgation of better tools for advancing recycling.

Disposal Restrictions

Disposal restrictions prevent the disposal of certain types of items, usually packaging. Four states – North Carolina, Wisconsin, Massachusetts, and Vermont – have established disposal restrictions for certain items. North Carolina is the closest state to Alabama and has the most comprehensive approach to restricted material. North Carolina also has measured results for some of the materials subject to the restrictions.

North Carolina enacted a prohibition on disposal of aluminum cans in 1994, and followed this in 2005 with restrictions on the disposal of beverage containers generated by bars and restaurants (Alcoholic Beverage Control permit holders) and most rigid plastic containers. The effective date was October of 2009, allowing for a four-year implementation that included outreach and infrastructure development. The 2005 legislation also required the ABC permit holders to establish recycling programs for the containers and cardboard. According to Scott Mouw with the N.C. Department of Environmental Quality, these restrictions were enacted in response to material demand and the need for collection infrastructure and activity.⁴⁹ At the time of the rigid plastic container disposal restriction, the southeast was home to 17 post-consumer plastic processors and end-users with a combined demand of over 1.4 billion pounds per year. Mouw’s report emphasizes that restrictions are a good way

⁴⁷ City of Austin, Texas, <http://www.austintexas.gov/uro>

⁴⁸ Betsy Dorn, “Local Policies that Drive Recycling”, Carolina Recycling Conference, March 2015

⁴⁹ Recycling Organizations of North America (RONA) Webinar <http://recyclingorganizations.org/webinars/Scott%20Mouw-RONA-Effects-of-NC-Disposal-Bans.pdf>

to reinforce the commodities status of recovered materials and begin to discuss materials management instead of waste management.

The N.C. DEQ does not have data showing “before” and “after” recovery figures for all affected materials. However, they do have data showing the recovery of materials since they were banned from disposal:

- Aluminum cans: 110,081 tons/year
- Rigid plastic containers: 130,201 tons/year⁵⁰

The capture rate for plastic containers was measured to have doubled between the passage of the legislated disposal restriction and the effective date. The N.C. DEQ has provided critical support to ensure the success of the material disposal restrictions and associated recycling through special grants dedicated to developing needed recycling infrastructure, extra credit in traditional grants for focusing on restricted materials, outreach to generators, media promotion, and training and education for all stakeholders.

Variable Rate Solid Waste Pricing

Variable solid waste pricing, also known as pay-as-you-throw (PAYT), is an incentive tool that rewards recycling behavior by treating solid waste service to residents as a utility, and charging for actual use as opposed to capacity. Typically, residents pay directly for the amount of trash they generate, and recycling is offered at no charge to all residents as a way for them to reduce their cost.

The Carton Council, a group of aseptic and gable-top carton manufacturers, actively promotes PAYT as a tool to increase recycling by engaging stakeholders to help promote the practice through a dedicated website specifically created to highlight the best practices needed for high performance, and to promote case studies of successful PAYT communities. The information below is summarized from the website.⁵¹ The authors of this study are appreciative in acknowledging the Carton Council for allowing the sharing of this information.

PAYT, when implemented using a best practices approach, is the most effective way to give households the opportunity to save money by disposing of less waste and doing more recycling. Similar to other utilities like electricity and water, households are charged based on the quantity of waste they produce. The more they dispose of, the more they pay, and the more they recycle, the less they dispose and the more they save.

More than 7,000 communities across the U.S. now have PAYT programs and boast impressive results. Research has found that adopting a PAYT program is the single

⁵⁰ Personal correspondence with Rob Taylor, NC DEQ

⁵¹ Carton Council et. al. “Payasyouthrow.org: The Leading Source of Information about how Cities and Towns can cut their Trash by 40-50% or more, help the Environment, and Save Money” www.payasyouthrow.org

most effective change a community can make to reduce the amount of waste disposed and increase recycling. The benefits of PAYT include the following:

- Cuts Waste in Half. PAYT communities on average dispose of 45% less waste than communities that include the cost of waste collection in property taxes or charge it as a fixed fee;
- Dramatically Increases Recycling. Research shows that variable rate systems result in a 20-40% increase in recycling tonnage;
- Saves Money. Often trash fees fall short of covering the full costs of waste disposal in a community. PAYT cuts disposal costs dramatically, provides a sustainable revenue stream when rates are designed with care, and defers the cost of future landfill development;
- Flexible to Implement. PAYT can be designed to meet the needs of any community, large or small, curbside or drop-off, urban or rural.

PAYT is generally implemented in one of three ways:

- Bags. Residents purchase special plastic bags, often designed with the city logo or other distinguishing logo or color, through city hall and/or local retailers. The price of the bags includes the cost of waste services. Residents can control their costs by choosing to throw less away, using fewer bags. Different bag sizes can be used to designate specific waste capacities.
- Variable Carts. Residents pay a fixed fee based on the size or number of carts they select for waste service. If they choose more or larger carts, they pay more.
- Tags or Stickers. Residents purchase special tags or stickers through city hall and/or local retailers. The price includes the cost of waste service, so the more tags/stickers used, the more they pay. Tags/stickers can designate specific volumes of waste, and unlike bags, they can be used for bulky wastes.

Pricing systems vary widely among communities, but generally fall into three categories:

- Fully Variable. All or most program costs are recovered through the unit fees paid by the generator (resident). To ensure full cost recovery, it is crucial that full program costs are known before setting fees and that future fee adjustments are permitted if needed;
- Two-Tiered. Like an electric bill, a two-tiered system charges the generator a fixed fee for the service regardless of use, and a variable fee that is determined based on use;
- Hybrid. Generators pay a fixed amount for a specified maximum volume of waste to be set out per collection period. Waste set out that exceeds this amount accrues an addition charge.

Provision of Recycling Service through Hauler Permitting/Licensing

Many counties and municipalities use hauler permitting or licensing programs to enhance the recycling infrastructure and access to recycling, while still allowing for

multiple haulers to service the community. Historically, hauler permitting and licensing programs are used to ensure that:

- Haulers are properly insured and bonded;
- Collection vehicles and commercial containers are properly maintained;
- Haulers follow guidelines regarding allowable hours of collection.

In some communities hauler licensing/permitting ordinances are also implemented to ensure that haulers providing trash collection services also provide collection of recyclable materials. In most cases ordinances state that recycling services must be provided “at no additional cost” to the resident – essentially requiring the hauler to “bundle” the services under one service fee. The provisions of the ordinance allow the community to have some control over service, despite not providing service directly nor having a contract/franchise agreement with the hauler(s). This can be especially beneficial in communities with subscription service.

Bundled services ordinances generally include the following characteristics:

- May apply to single-family dwellings, multi-family dwellings, and commercial/institutional customers.
- May require PAYT, and may stipulate pricing differentials and option of a “mini can” or small cart.
- May stipulate specific service provisions such as:
 - Materials to be included in the recycling programs;
 - Where recyclables are to be delivered;
 - The manner in which materials are to be collected (e.g., “single-stream”)
 - Minimum frequency of collection (usually weekly or bi-weekly);
 - Same-day service;
 - Curb service and/or reduced fees for eligible elderly or low-income customers;
 - Yard debris or organics collection and collection of bulky items (sometimes at an additional fee);
- May specify container types/size/recycled content, or that hauler provides containers.
- A licensing fee may be charged to cover the administrative cost of implementing the program (often a per-vehicle fee or a flat fee per company plus a per-vehicle fee).
- Reporting requirements may be included.
- May require haulers to develop/distribute education and outreach materials, inform residents (or new residents) of recycling options,
- May specify that services can be provided through a subcontractor/agent.
- May set rates or rate structure.

The service provision of recycling as a permit condition would apply only to the haulers and collectors. Participation requirements for the residents is a separate, but related approach. With provision of service requirements, haulers must provide recycling services. Universal service adds more specificity, requiring recycling collection wherever trash collection is provided, including residential and commercial locations, venues, and events. Provision of service requires that customers must participate in recycling programs by separating recyclable materials.

The benefits of the approach include:

- Allowing multiple haulers to serve the community, which may be more politically acceptable than managed collection, and may support industry competition in the long run. This assumes that exclusive franchise service areas are not established.
- Increasing participation in recycling programs over subscription service, as residents automatically receive service availability and possibly a recycling container.
- Enhances cost-effectiveness of recycling through improved economies of scale.
- Can provide for some level of consistency of service throughout the community, which limits confusion about what can be recycled and how to prepare materials.
- Ensures availability of desired data to community officials.
- Implementable in small or large communities, rural or urban.
- May allow for the use of a subcontractor if trash hauler lacks ability or equipment to provide certain services (i.e. organics collection).
- Ordinances can include penalties so that responsible parties have incentive to comply.
- Can allow for increased requirements as infrastructure develops.
- Flexibility can provide for exceptions as needed, such as:
 - Multi-family dwellings that lack adequate space for recycling;
 - Exemption from collecting certain materials if no market exists; and
 - Exceptions for businesses and residences that self-haul garbage and/or recyclables.

For best results, the following best management practices should be followed:

- If recycling carts used, they are provided to all residents, rather than requiring them to sign up for the service (the default is inclusion).
- For consistency, community develops education and outreach materials and has hauler distribute them. Work with surrounding communities/MRF-shed(s), if possible. This study recommends that ADEM establish common suite of materials to be collected and develop the standard messaging for use by local governments.
- Building codes implemented to ensure new multi-family units/commercial buildings have adequate space allocated for recycling containers.
- Reporting requirements for haulers consider those of surrounding communities and are developed with hauler/facility input.
- Other tools that enhance recycling are also considered as part of the program, such as PAYT, required recycling of certain materials, universal recycling, and disposal restrictions.

Examples of some communities that have implemented bundled services are provided in Table 29.

TABLE 29: COMMUNITIES WITH BUNDLED SERVICES

Community	Selected Program Elements
Kane County, IL Population 530,847 (2015)	<ul style="list-style-type: none"> • Haulers must collect recyclables from all garbage customers – residential, commercial, and multi-family. • Property owners (residential, commercial, multi-family) also have responsibility to provide service. • Individuals (residents of single-family (SF) and multi-family (MF), commercial building managers) must also participate in recycling. • Haulers may not collect garbage from buildings that do not recycle.
Fort Collins, CO Population 156,480 (2014)	<ul style="list-style-type: none"> • Unlimited recycling must be provided to residential garbage customers “who desire such service” for no additional charge. • Structure of fee specified, but not amount (e.g., intended to provide incentive to reduce amount of waste disposed). • Additional fees cannot be charged to residents. • Haulers must offer recycling to commercial and multi-family dwellings (MFDs). • City in process of revising ordinance.
Lenexa, KS Population 50,344 (2013)	<ul style="list-style-type: none"> • Haulers serving residential garbage customers must also collect weekly unlimited recyclables from those customers, as well as yard waste (weekly 9 months of year, monthly winter months), at no extra cost. • Haulers collecting trash from MFDs must also collect recyclables from them at a bundled price. • Recycling and garbage containers to be provided by hauler, recycling container must be at least as large as garbage container. • County ordinance (Johnson County) applies to incorporated areas as well as unincorporated, and stipulates variable rate pricing must be implemented. • Residents and owners required to separate recyclables from trash, and keep area around containers neat. • Yard waste must be set out separately from recyclables. • Ordinance does not apply to commercial properties beyond MFDs.

Best Practice: Restructure Grant Program

The State of Alabama should restructure its recycling grant program to support all of the facets of this reports' recommended new recycling system by:

- 1. Being strategic in awarding grants to use them to create a statewide recycling system built on identifying areas of maximum potential recovery and building the infrastructure needed to establish and manage this infrastructure. Incorporate existing investments into the system, but avoid duplication of effort.*
- 2. Targeting grant funds to the four foundational building blocks of large-scale material recovery: cart-based single-stream curbside collection; staffed multi-material convenience centers for drop-off recycling for rural and multi-family residents; efficient transfer and delivery of recyclables, and large-scale, regional material recovery facilities (MRFs) that process and market the recyclables.*
- 3. Clearly outlining reporting requirements along with grant awards, be very specific about the data required, and provide tools to make reporting easier and more accurate. Without amending the regulations, ADEM could develop reporting checklists and forms or templates to assist local governments in gathering and communicating the metrics that are most important in evaluating effectiveness. The State of North Carolina Department of Environmental Quality, Division of Environmental Assistance and Customer Service (DEACS) provides grantees with detailed instructions on submitting final reports that ADEM should consider using as a model.⁵²*

Alabama's 2008 Solid Wastes and Recyclables Materials Management Act (SWRMMA), established a statewide recycling/waste reduction program, provided funding for ADEM to administer the act, and established the Alabama Recycling Fund (ARF) to provide grants to local governments in support of their recycling programs. The ARF is funded by a portion of the statewide solid waste disposal fee of \$1.00 per ton. Regulations pertaining to the ARF grant program are found in Alabama Administrative Code, Chapter 335-13-10.

One purpose of this report was to assess the impact the grants program has had on material recovery in the state, and how the grant program can be used to make strategic investments in Alabama's material recovery infrastructure.

Summary of Grants Program

Since 2009, the Department has awarded 112 recycling grants from the ARF to 54 different communities and agencies. The total expenditure through fiscal year 2015 was \$ 12,918,175.

⁵² "Curbside Recycling Roll-Out Cart Grant Program – Final Report Guidelines", NC DEQ, DEACS. <http://deq.nc.gov/conservation/recycling/local-government-recycling-assistance/grant-programs>

Table 30 summarizes the expenditures per year since the programs' inception.

TABLE 30
ADEM RECYCLING GRANTS
AWARDED, PER YEAR

Year	Amount Awarded	# Grants Awarded
2009	\$1,162,052.62	8
2010	\$1,654,106.12	13
2011	\$2,000,000.51	20
2012	\$2,009,006.36	15
2013	\$2,363,640.18	18
2014	\$1,899,997.31	16
2015	\$1,829,372.46	22

53

An examination of the grant award data revealed that certain local jurisdictions received significant amounts of money in grants over multiple years. A total of 27 awardees received more than one grant over the fiscal years 2009 through 2015, accounting for 76 percent of the grants awarded and 81 percent of the available grant funding. Looking more closely, the top 12 jurisdictions that were awarded the largest total funding over the period accounted for a total of 44 percent of the grants and 66 percent of the available funds. Tables 31 and 32 summarize these findings.

The top 12 funded organizations listed in Table 31 serve over 34 percent of the state's population. This grant support enabled these jurisdictions to provide leadership in bringing cart-based curbside recycling programs, recyclables processing capacity and educational programs to their residents.

TABLE 31

Top 12 Funded Organizations	Number of Grants	Total Dollars
Dothan	6	\$ 1,188,325
EARP	7	\$ 1,157,782
Tuscaloosa City	5	\$ 1,071,528
Florence City	4	\$ 1,022,617
Jefferson County BOH	5	\$ 916,649
Calhoun Co.	4	\$ 709,386
Albertville/Boaz	5	\$ 611,980
Shoals SWA	4	\$ 450,964
Troy City	2	\$ 417,000
Athens/Limestone	4	\$ 363,426
Florence/UNA/Rogersville	2	\$ 332,295
Tuscaloosa/Northport/Tusc Co.	1	\$ 279,150
TOTALS	49	\$ 8,521,102
PERCENT OF ALL AWARDS	44%	66%

TABLE 32

Multiple Grant Recipients	Number of Grants	Total Dollars
EARP	7	\$ 1,157,782
Dothan	6	\$ 1,188,325
Albertville/Boaz	5	\$ 611,980
Jefferson County BOH	5	\$ 916,649
Tuscaloosa City	5	\$ 1,071,528
Athens/Limestone	4	\$ 363,426
Calhoun Co.	4	\$ 709,386
Florence City	4	\$ 1,022,617
Shoals SWA	4	\$ 450,964
Alexander city	3	\$ 147,457
Daphne City	3	\$ 146,229
Elmore County	3	\$ 242,434
Eufaula City	3	\$ 255,911
Guntersville City	3	\$ 125,608
Baldwin County	2	\$ 92,850
Clay County	2	\$ 39,488
Columbiana City	2	\$ 18,581
Decatur	2	\$ 170,253
Florence/UNA/Rogersville	2	\$ 332,295
Gadsden City	2	\$ 227,504
Huntsville	2	\$ 40,999
Livingston City	2	\$ 211,132
Mobile County	2	\$ 176,500
Prattville	2	\$ 57,460
Selma City	2	\$ 144,844
Statewide Recycling Campaign	2	\$ 150,000
Troy City	2	\$ 417,000
TOTALS	85	\$ 10,489,202
PERCENT OF ALL AWARDS	76%	81%

⁵³ Email exchanges with ADEM staff

Although the general criteria in the Regulations were reviewed, the authors of this report did not have information about the factors that were considered in deciding to award grants to certain communities, and it was beyond the scope of this report to examine and evaluate each grant award individually. Generally, grant funding should be strategically applied to avoid duplication of effort, and ensure that funding is used efficiently and effectively to move materials to large, regional processors and to market quickly.

Grants Survey

The authors of this report conducted a survey of communities that received grants to determine how the grants were used and what impact they have had. Communities were identified using ADEM records and an email survey was sent to 52 local governments or agencies that received grants. Communities that did not respond received email reminders and phone calls. Internet research was also used to fill in any gaps. The survey asked communities to report on which years they obtained grants, the amounts per year, what the funds were used for, any specific materials that were targeted, and before and after recovery numbers. The survey is attached in the Appendix of this report.

Survey responses were received from 17 grant recipients, including five of the multiple grant recipients. Five of the surveyed communities reported increases in recovery tonnage over the grant timeframes of over 50 percent, four communities reported results less than 50 percent, one community reported a decrease in material, and seven communities provided no data. The largest reported increase was 233 percent by the City of Dothan, and a 12 percent decrease was reported by the Athens/Limestone County Recycling Center due to curbside material going to the Decatur program.

Table 33 presents the tonnages from nine communities, totaled over the multiple years they received funding.

TABLE 33
RESULTS OF GRANT FUNDING

Grant Recipient	Tons per Year Before	Tons per Year After	Increase	Comments from Recipient
Alexander City	164	270	106	Increased social media promotion, more schools recycling
City of Daphne	1,376	1,721	345	Carts, trailer to transport glass crusher
City of Dothan	720	2,400	1,680	Increase due to curbside collection with carts
City of Florence	3,140	3,500	360	Recycling center improvements, community event collection for Rogersville and Killen, multi-media campaign
City of Gadsden	213	408	195	Additional collection trailers at businesses; educational outreach
EARP	130	320	190	2-year goal to increase cardboard tonnage, also increasing curbside in Opelika
Mobile County	1,200	2,196	996	TV and monitor collection event, new recycling center for drop-off
Town of Guntersville	1,005	1,173	168	Event recycling, outreach to business community
Town of Scottsboro	646	1,667	1,021	Educational supplies, truck, carts, totes, green bags
TOTAL INCREASE AS REPORTED			5,061	Tons

The total reported increase from these communities is 5,081 tons. The results show that the Alabama Recycling Fund has had an impact in boosting material recovery and recycling in these communities. While the composition of the recovered tonnages is not known, and may consist of materials other than standard curbside recyclables, it can be stated with confidence that at the average tipping fee of \$44.46 per ton, recovering these materials saved \$225,901 annually in avoided tipping fees for disposal.

Given the positive results reported by these communities, it is likely that the communities not reporting data, as well as the communities that did not respond to the survey, also experienced recovery increases as a result of support from the Recycling Fund. With only 17% of the 54 grant recipients responding to the survey, the overall impact of the grants program is certainly understated. If the average increase of 565 tons annually from these nine respondents is credited to the

remaining 45 recipients, the actual annual tonnage increase can be extrapolated to an additional 25,405 tons of recovered material. The impact in avoided disposal fees from this estimated total recovery of 30,486 tons is about \$1.3 million. Additionally, using Dr. Hefner's model, it can be calculated that the additional recovery was responsible, either directly or indirectly, for 51 jobs in Alabama. These recovery calculations, while based on extrapolations, clearly show that the Alabama Recycling Fund has been a significant driver of recovery for local governments that otherwise lacked the resources to implement community collection, processing and educational initiatives.

While the regulations require grantees to keep records and report results, many communities are not performing well in this requirement. Grant recipients are required by rule to do the following:

- Report semi-annually on the status of the recycling project or program funded by the grant, on April 15th and October 15th (335-13-10-.04(4));
- Provide an estimate of the quantity, source, and type of materials to be collected and recycled under the proposed project or program, including an explanation of the methods used to estimate the quantity (335-13-10-.07(1b)); and
- Include in the grant application a description of the methods to be used in evaluating the success of the project or program, and report such progress in the semi-annual reports (335-13-10-.07(1i)).

APPENDIX

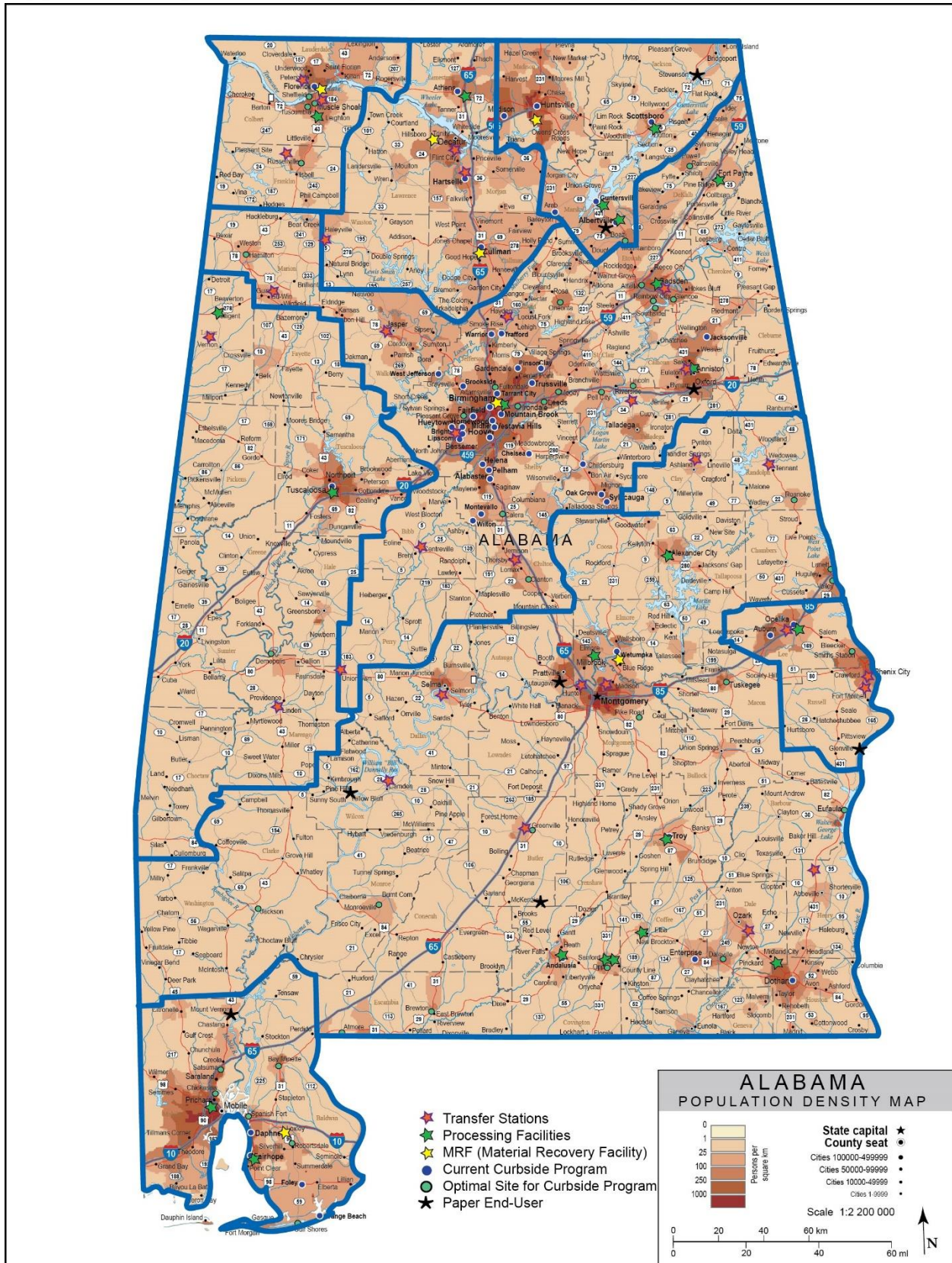
Appendix Table 1: Alabama Curbside Cities, Existing and Planned

New or Existing Curbside Program	City/Town	MSA or County	County	City or Town Population	Total Households in city or town	Percent single-family households	Total single-family population
E	Birmingham	Birmingham-Hoover MSA	Jefferson	212,247	88,817	71%	62,794
N	Montgomery	Montgomery MSA	Montgomery	200,481	79,760	82%	65,642
N	Mobile	Mobile MSA	Mobile	194,675	75,653	80%	60,371
E	Huntsville	Huntsville MSA	Madison	188,226	76,959	77%	59,258
E	Madison County, unincorporated	Huntsville MSA	Madison	112,718	39,245	79%	30,964
E	Tuscaloosa	Tuscaloosa MSA	Tuscaloosa	96,122	31,794	63%	19,998
E	Hoover	Birmingham-Hoover MSA	Jefferson	84,353	32,375	72%	23,245
E	Dothan	Dothan MSA	Houston	68,409	25,935	89%	23,004
E	Auburn	Auburn-Opelika MSA	Lee	60,258	21,644	64%	13,831
E	Decatur	Decatur MSA	Morgan	55,532	22,006	83%	18,287
E	Madison	Huntsville MSA	Madison	46,450	16,583	81%	13,366
E	Florence	Florence-Muscle Shoals MSA	Lauderdale	40,215	17,617	83%	14,693
N	Phenix City	Russell County	Russell	37,540	13,787	80%	11,030
N	Gadsden	Gadsden MSA	Etowah	36,295	14,689	90%	13,191
N	Prattville	Montgomery MSA	Autauga	35,317	12,480	88%	11,032
E	Vestavia Hills	Birmingham-Hoover MSA	Jefferson	34,124	13,637	81%	10,978
E	Alabaster	Birmingham-Hoover MSA	Shelby	31,545	10,416	95%	9,843
E	Opelika	Auburn-Opelika MSA	Lee	29,171	11,183	88%	9,841
E	Enterprise	Coffee County	Coffee	27,772	10,182	90%	9,113
N	Bessemer	Birmingham-Hoover MSA	Jefferson	26,949	10,457	89%	9,328
E	Homewood	Birmingham-Hoover MSA	Jefferson	25,802	9,306	66%	6,179
N	Northport	Tuscaloosa MSA	Tuscaloosa	24,709	8,924	85%	7,585
E	Athens	Huntsville MSA	Limestone	24,522	9,203	88%	8,099
E	Daphne	Daphne-Fairhope-Foley MSA	Baldwin	24,395	8,731	75%	6,513
E	Pelham	Birmingham-Hoover MSA	Shelby	22,699	8,619	97%	8,395
N	Anniston	Anniston-Oxford-Jacksonville MSA	Calhoun	22,457	9,415	87%	8,191
N	Prichard	Mobile MSA	Mobile	22,312	8,271	95%	7,882
E	Albertville	Marshall County	Marshall	21,458	7,215	92%	6,609
N	Oxford	Anniston-Oxford-Jacksonville MSA	Calhoun	21,155	7,543	97%	7,309
E	Mountain Brook	Birmingham-Hoover MSA	Jefferson	20,734	7,481	94%	7,002
E	Trussville	Birmingham-Hoover MSA	Jefferson	20,702	7,124	97%	6,889
N	Selma	Dallas County	Dallas	19,814	7,765	92%	7,113
E	Troy	Pike County	Pike	19,138	6,762	81%	5,504
E	Fairhope	Daphne-Fairhope-Foley MSA	Baldwin	18,089	6,631	89%	5,921
E	Helena	Birmingham-Hoover MSA	Shelby	17,833	5,825	100%	5,808
N	Center Point	Birmingham-Hoover MSA	Jefferson	16,777	6,303	84%	5,276
E	Foley	Daphne-Fairhope-Foley MSA	Baldwin	16,243	6,644	84%	5,548
N	Talladega	Talladega County	Talladega	16,012	5,508	91%	4,996
E	Hueytown	Birmingham-Hoover MSA	Jefferson	15,815	6,008	94%	5,654
N	Millbrook	Montgomery MSA	Elmore	15,169	5,778	87%	5,015
E	Cullman	Cullman County	Cullman	15,145	6,109	81%	4,954
N	Alexander City	Tallapoosa County	Tallapoosa	14,849	5,808	90%	5,233
E	Scottsboro	Jackson County	Jackson	14,748	6,071	90%	5,476
N	Ozark	Dale County	Dale	14,700	6,214	82%	5,102
E	Hartselle	Decatur MSA	Morgan	14,459	5,299	91%	4,827
N	Fort Payne	DeKalb County	DeKalb	14,125	5,122	78%	4,005
N	Jasper	Birmingham-Hoover MSA	Walker	14,109	5,397	84%	4,523

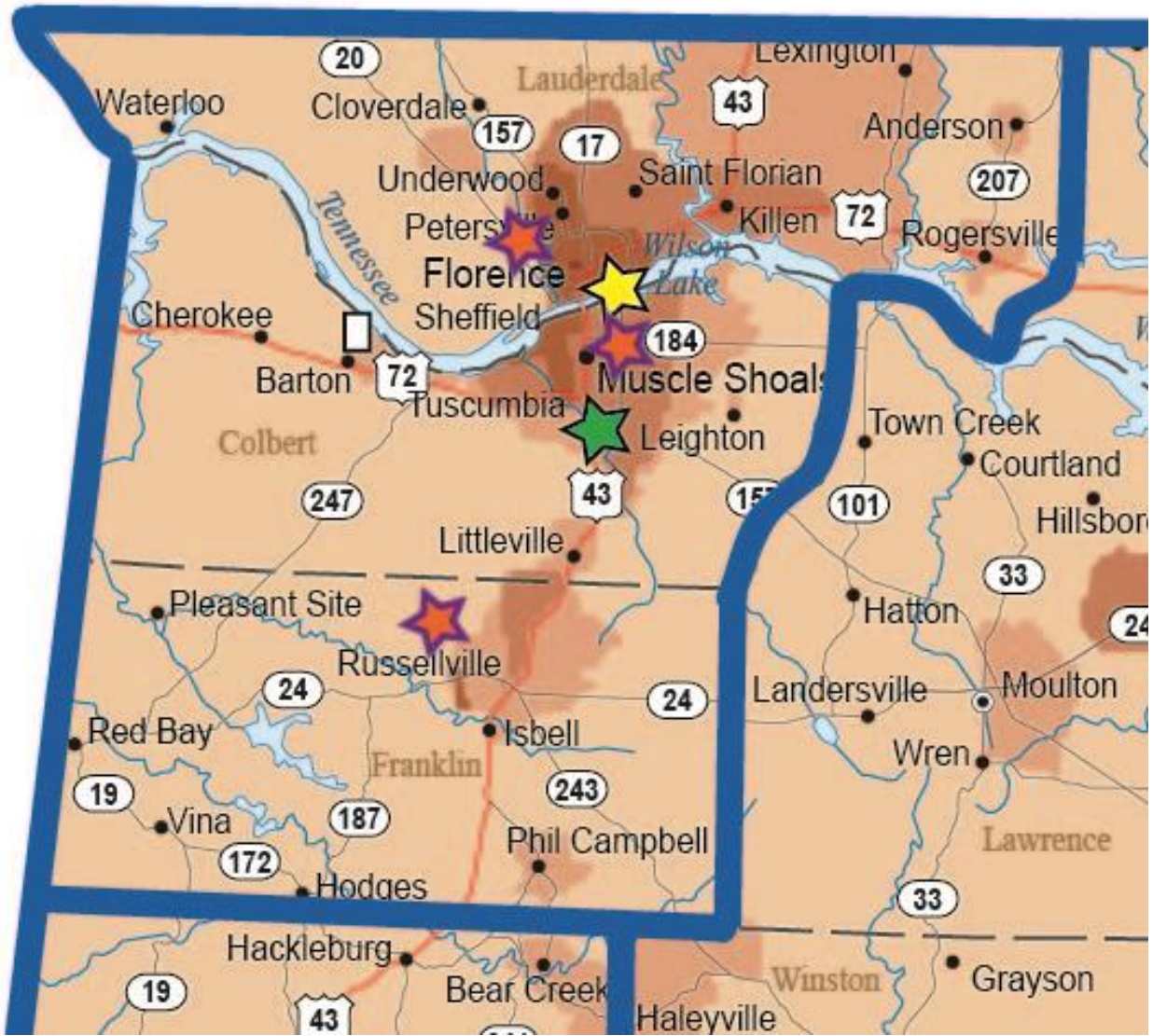
New or Existing Curbside Program	City/Town	MSA or County	County	City or Town Population	Total Households in city or town	Percent single-family households	Total single-family population
N	Saraland	Mobile MSA	Mobile	13,744	5,058	84%	4,244
N	Gardendale	Birmingham-Hoover MSA	Jefferson	13,735	5,696	90%	5,109
N	Muscle Shoals	Florence-Musc Shoals MSA	Colbert	13,614	5,539	91%	5,013
N	Pell City	Birmingham-Hoover MSA	St. Clair	13,573	5,111	79%	4,038
N	Calera	Birmingham-Hoover MSA	Shelby	12,972	4,724	93%	4,370
N	Eufaula	Barbour	Barbour	12,781	4,811	79%	3,801
E	Sylacauga	Talladega County	Talladega	12,703	5,078	89%	4,509
N	Moody	Birmingham-Hoover MSA	St. Clair	12,457	4,785	83%	3,991
N	Irondale	Birmingham-Hoover MSA	Jefferson	12,444	5,454	69%	3,747
E	Jacksonville City	Anniston-Oxford-Jacksonville MSA	Calhoun	12,250	4,364	76%	3,299
N	Leeds	Birmingham-Hoover MSA	Jefferson	11,939	4,590	82%	3,759
E	Chelsea	Birmingham-Hoover MSA	Shelby	11,758	3,696	100%	3,685
N	Gulf Shores	Daphne-Fairhope-Foley MSA	Baldwin	10,963	4,728	47%	2,213
E	Fairfield	Birmingham-Hoover MSA	Jefferson	10,592	3,954	85%	3,361
N	Pleasant Grove	Birmingham-Hoover MSA	Jefferson	10,325	3,605	97%	3,504
N	Atmore	Escambia	Escambia	10,006	3,263	81%	2,650
N	Russellville	Franklin	Franklin	9,806	3,553	76%	2,714
E	Clay	Birmingham-Hoover MSA	Jefferson	9,700	3,724	97%	3,594
N	Boaz	Marshall (Etowah)	Marshall	9,689	3,490	85%	2,960
N	Rainbow City	Gadsden MSA	Etowah	9,606	4,014	73%	2,922
N	Valley	Chambers	Chambers	9,453	3,698	72%	2,655
N	Sheffield	Florence-Musc Shoals MSA	Colbert	9,144	3,918	90%	3,530
E	Andalusia	Covington County	Covington	9,081	3,522	92%	3,247
N	Bay Minette	Daphne-Fairhope-Foley MSA	Baldwin	9,049	2,835	82%	2,333
N	Tuskegee	Macon	Macon	8,993	3,413	81%	2,754
N	Fultondale	Birmingham-Hoover MSA	Jefferson	8,908	3,862	69%	2,649
N	Clanton	Birmingham-Hoover MSA	Chilton	8,727	3,358	89%	2,989
N	Southside	Gadsden MSA	Etowah	8,552	2,820	92%	2,603
E	Guntersville	Marshall County	Marshall	8,358	3,201	89%	2,846
N	Tuscumbia	Florence-Musc Shoals MSA	Colbert	8,358	3,776	88%	3,330
E	Arab	Marshall County	Marshall	8,284	3,335	92%	3,058
N	Pike Road	Montgomery MSA	Montgomery	7,933	2,440	99%	2,416
N	Greenville	Butler	Butler	7,902	3,295	82%	2,705
N	Spanish Fort	Daphne-Fairhope-Foley MSA	Baldwin	7,806	2,955	61%	1,808
E	Wetumpka	Montgomery MSA	Elmore	7,661	2,437	87%	2,128
N	Demopolis	Marengo	Marengo	7,182	2,985	80%	2,373
E	Pinson	Birmingham-Hoover MSA	Jefferson	7,143	2,798	97%	2,706
N	Hamilton	Marion	Marion	6,790	2,556	79%	2,029
N	Opp	Covington	Covington	6,677	2,478	90%	2,220
N	Oneonta	Birmingham-Hoover MSA	Blount	6,627	2,441	84%	2,041
E	Montevallo	Birmingham-Hoover MSA	Shelby	6,601	2,450	74%	1,806
N	Lanett	Chambers	Chambers	6,447	2,617	94%	2,455
N	Lincoln	Talladega	Talladega	6,438	2,581	67%	1,719
E	Tarrant	Birmingham-Hoover MSA	Jefferson	6,397	2,573	95%	2,442
N	Monroeville	Monroe	Monroe	6,189	2,148	82%	1,751
N	Satsuma	Mobile MSA	Mobile	6,167	2,322	96%	2,234

New or Existing Curbside Program	City/Town	MSA or County	County	City or Town Population	Total Households in city or town	Percent single-family households	Total single-family population
N	Chickasaw	Mobile MSA	Mobile	5,981	2,300	99%	2,272
N	Roanoke	Randolph	Randolph	5,970	2,440	76%	1,847
N	Attalla	Gadsden MSA	Etowah	5,940	2,287	86%	1,971
E	Orange Beach	Daphne-Fairhope-Foley MSA	Baldwin	5,788	2,285	29%	651
N	Robertsdale	Daphne-Fairhope-Foley MSA	Baldwin	5,773	1,900	72%	1,376
N	Brewton	Escambia	Escambia	5,391	2,209	91%	1,999
E	Midfield	Birmingham-Hoover MSA	Jefferson	5,263	1,932	98%	1,897
N	Smiths Station	Auburn-Opelika MSA	Lee	5,251	1,927	72%	1,391
N	Glencoe	Gadsden MSA	Etowah	5,174	2,113	75%	1,574
N	Daleville	Dale	Dale	5,142	2,197	70%	1,538
E	Childersburg	Talladega County	Talladega	5,068	2,130	94%	2,004
N	Jackson	Clarke	Clarke	5,025	1,895	79%	1,488
N	Rainsville	DeKalb	DeKalb	5,011	2,001	83%	1,665
E	Warrior	Birmingham-Hoover MSA	Jefferson	3,176	1,270	95%	1,207
E	Brighton	Birmingham-Hoover MSA	Jefferson	2,896	1,158	95%	1,100
E	Lipscomb	Birmingham-Hoover MSA	Jefferson	2,210	884	95%	840
E	Brookside	Birmingham-Hoover MSA	Jefferson	1,343	537	95%	510
E	Wilton	Birmingham-Hoover MSA	Shelby	687	275	95%	261
E	T rafford	Birmingham-Hoover MSA	Jefferson	645	258	95%	245
E	Oak Grove	Talladega County	Talladega	528	211	95%	201
E	West Jefferson	Birmingham-Hoover MSA	Jefferson	334	134	95%	127
TOTALS				2,644,489	1,012,690		819,891

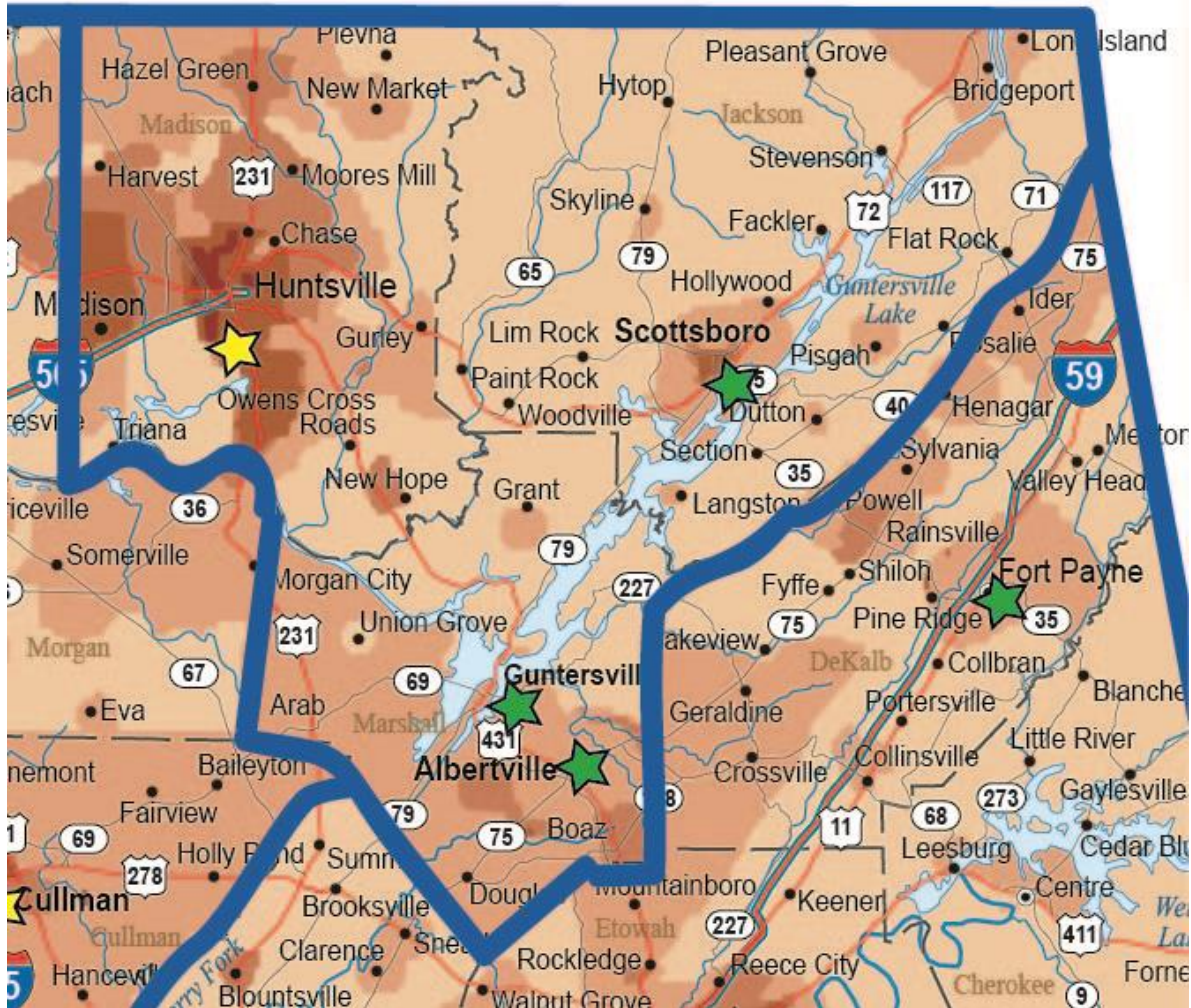
Appendix Map 1: Alabama Proposed Hub and Spoke Regions



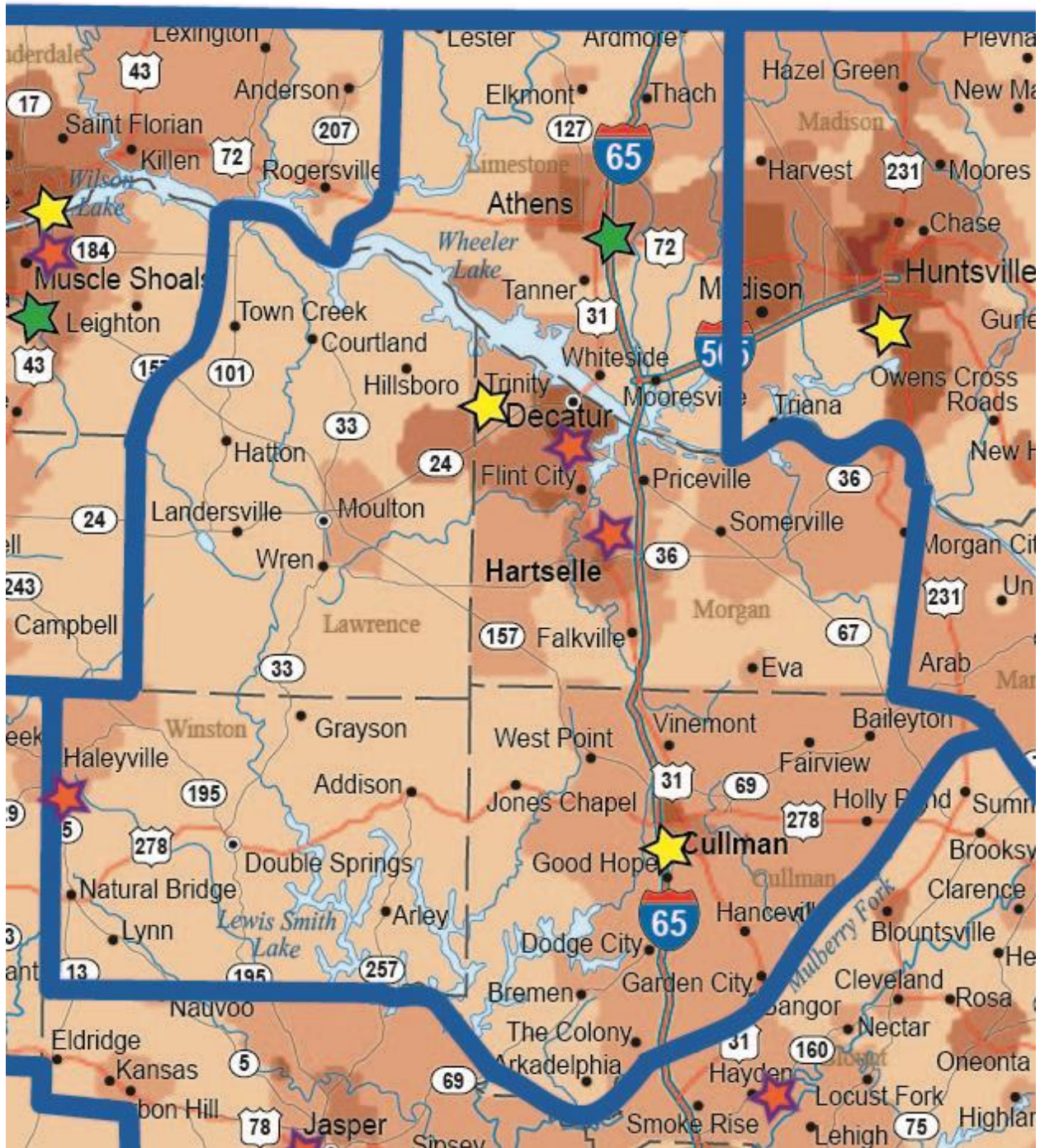
Appendix Map 2: Region 1, Florence Hub



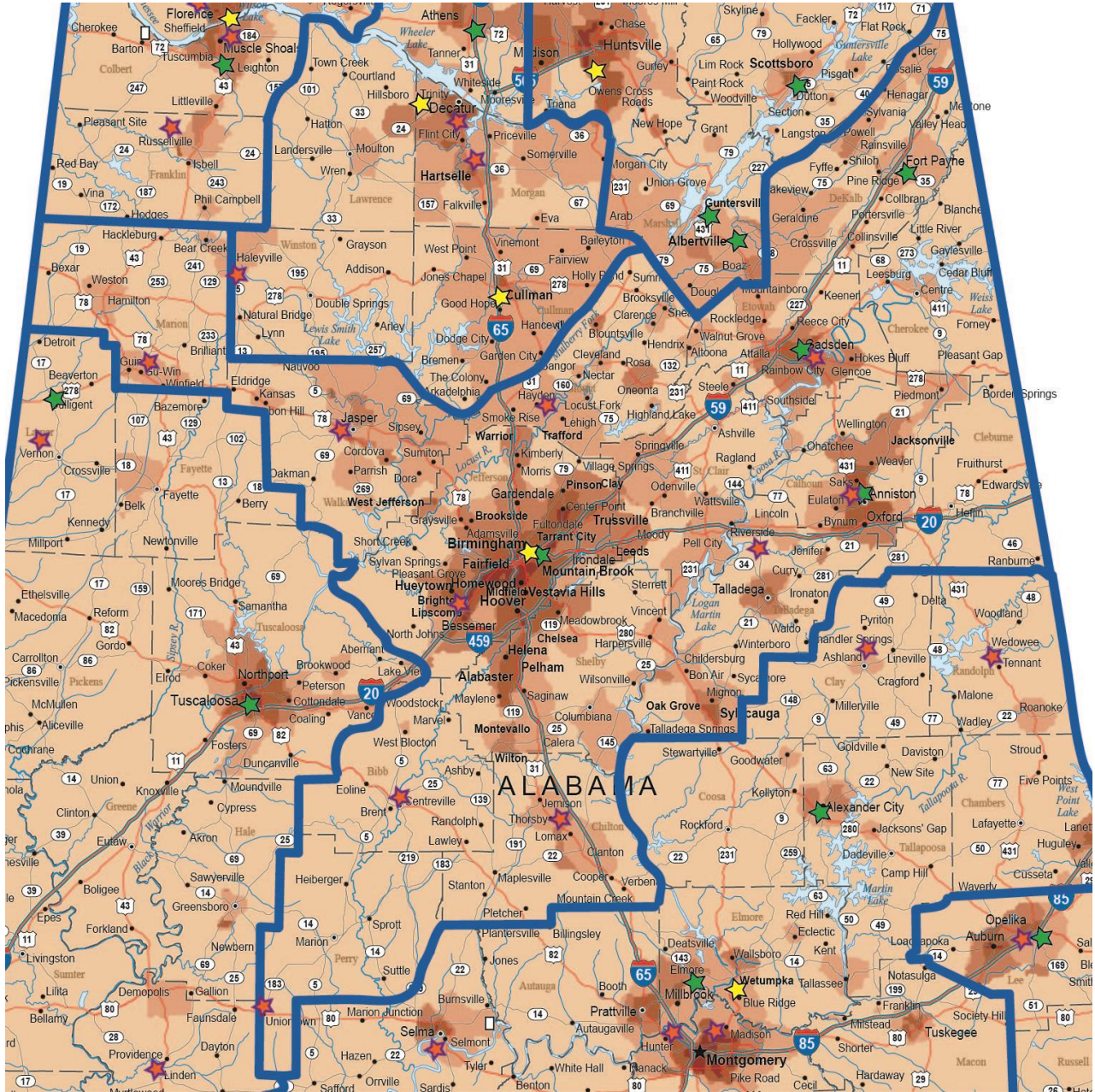
Appendix Map 3: Region 2, Huntsville Hub



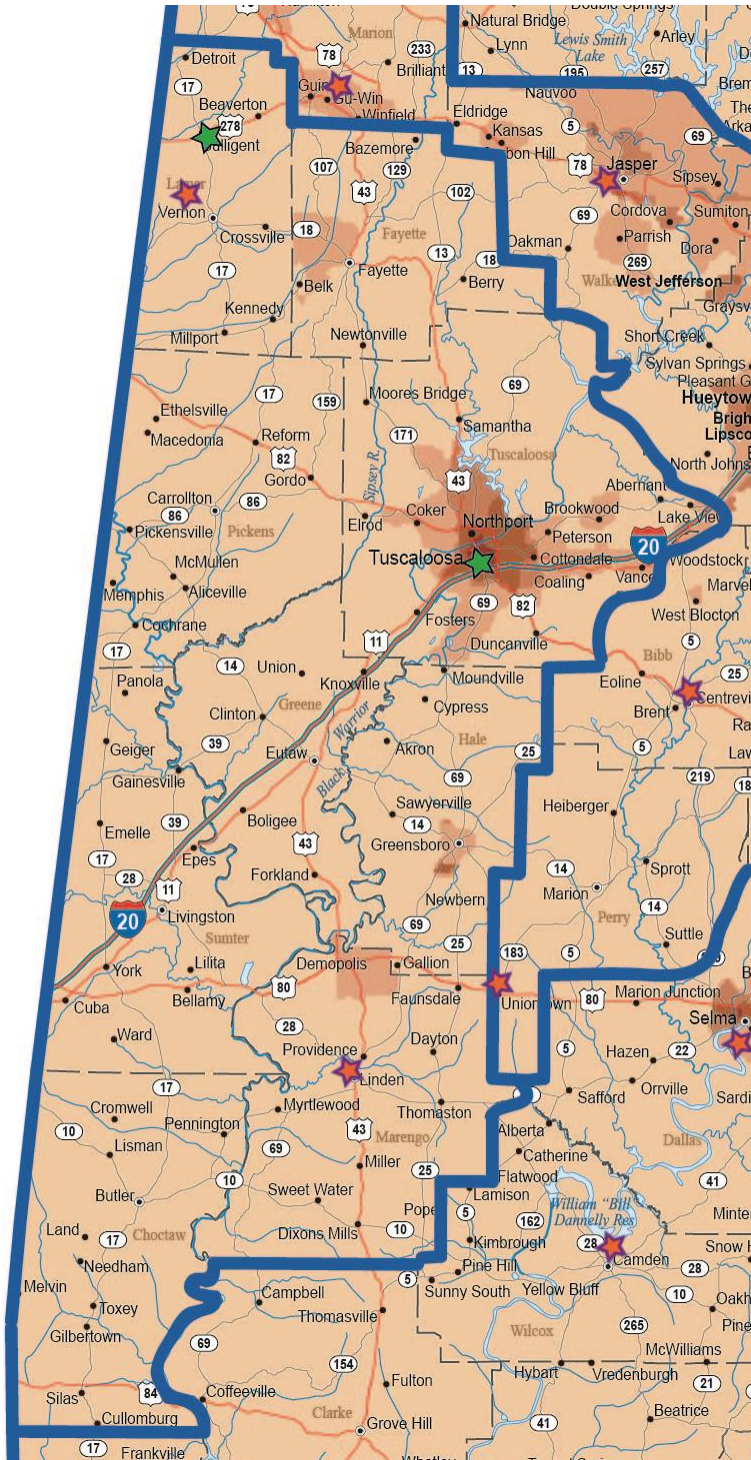
Appendix Map 4: Region 3, Decatur Hub



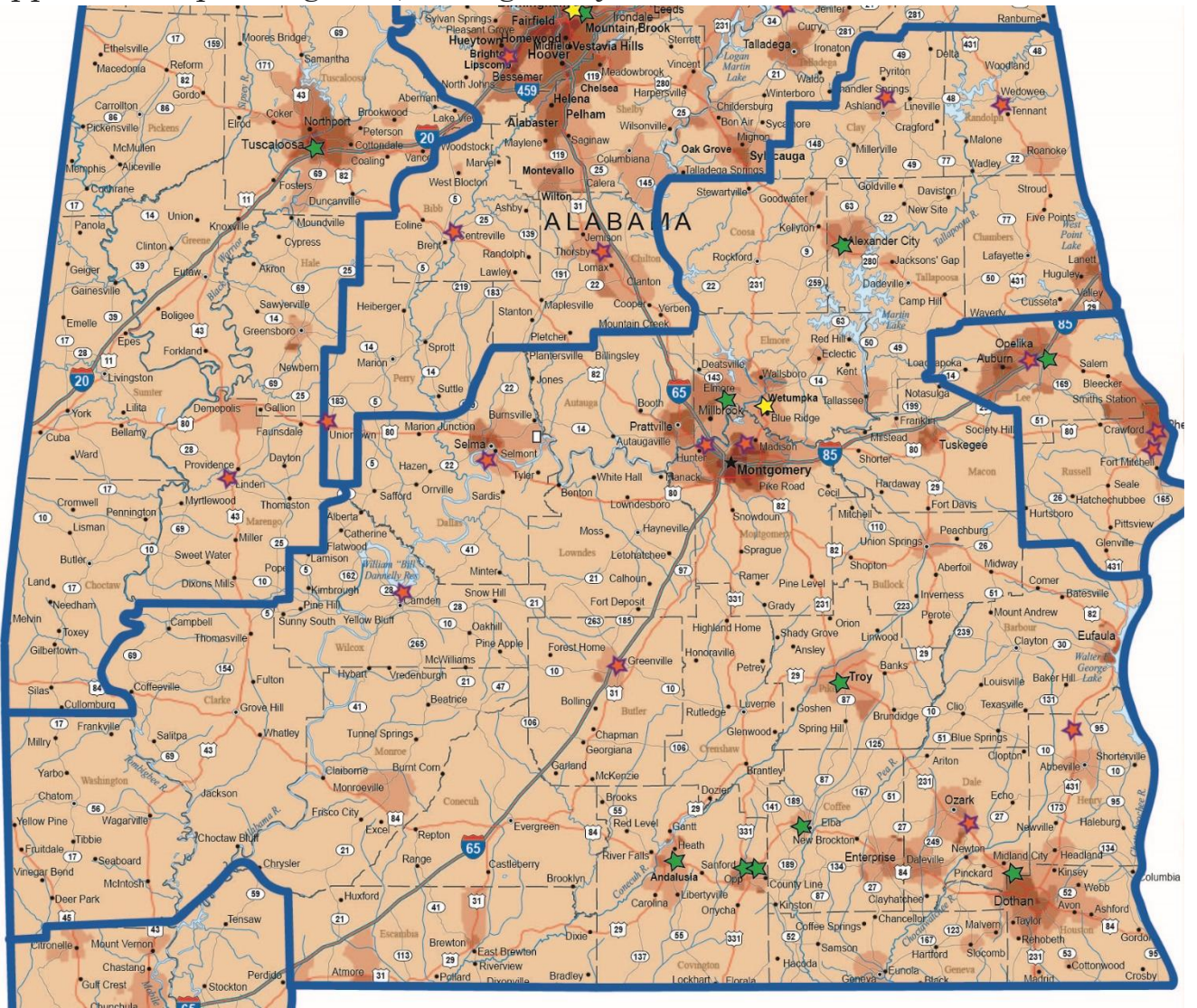
Appendix Map 5: Region 4, Birmingham Hub



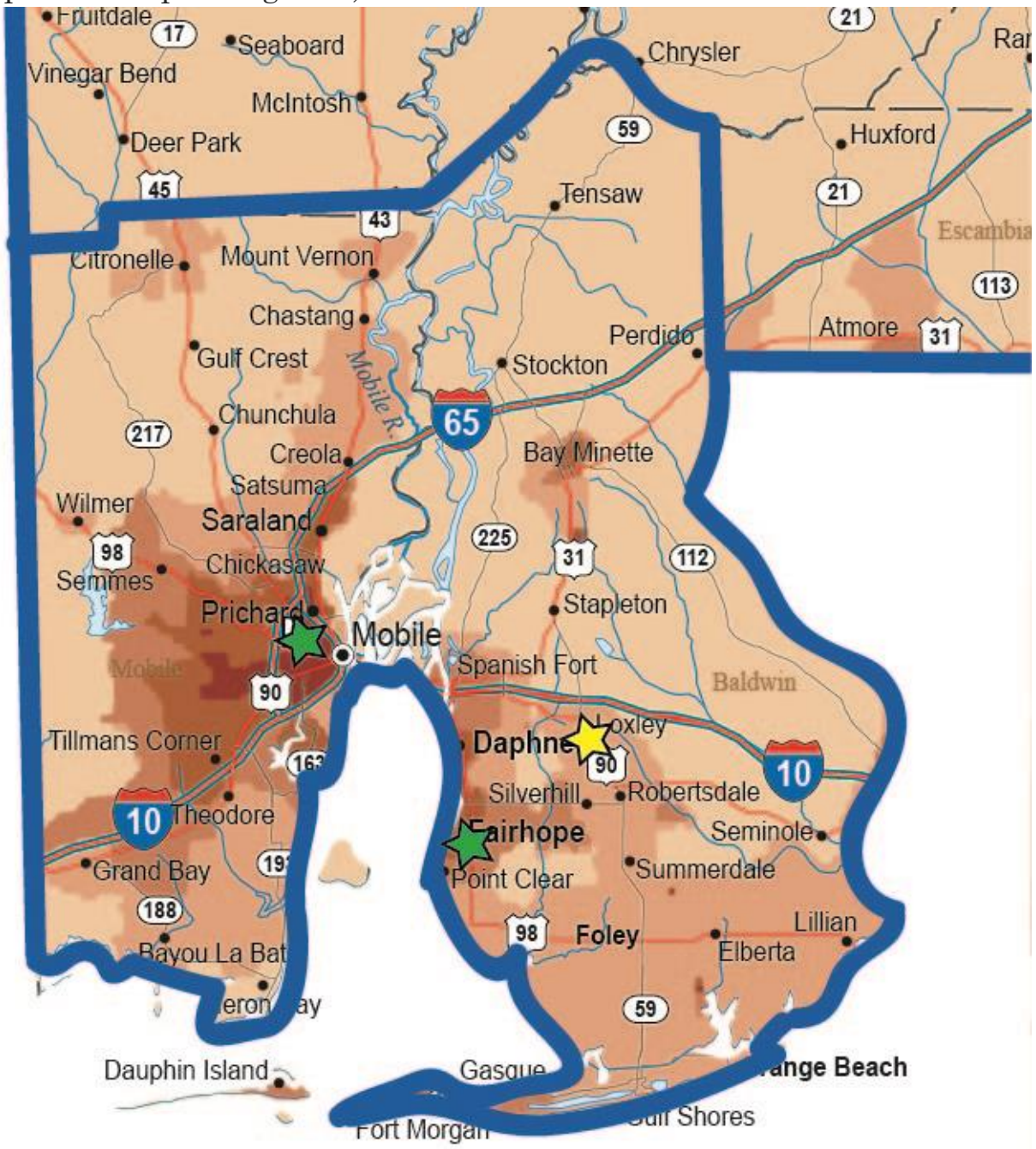
Appendix Map 6: Region 5, Tuscaloosa Hub



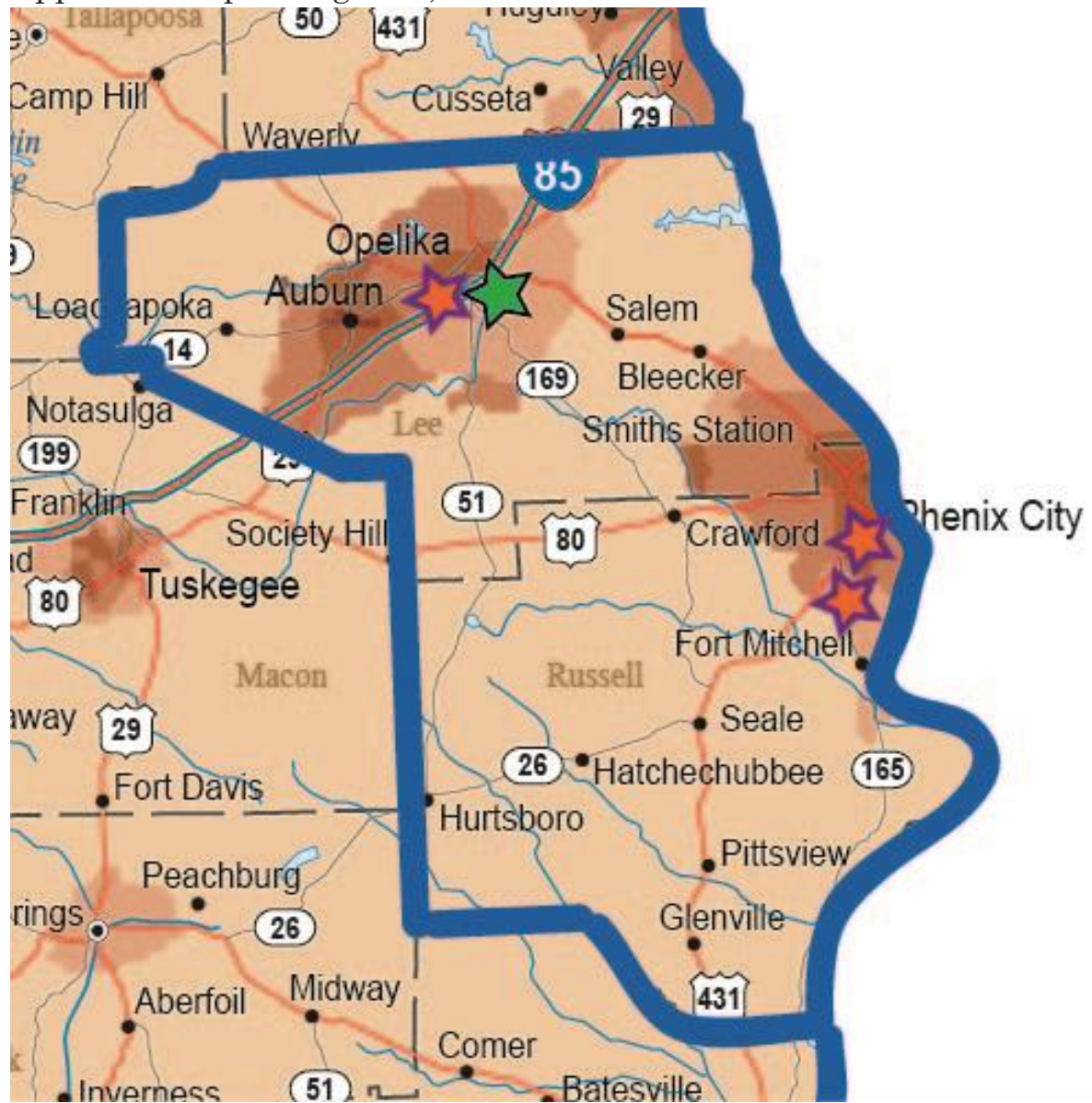
Appendix Map 7: Region 6, Montgomery Hub



Appendix Map 8: Region 7, Mobile Hub



Appendix Map 9: Region 8, Columbus GA Hub





Selected Excerpts Addressing Waste Composition Methodology

From: Analysis of Tennessee’s Household Generated Waste

Determining the Quantity and Value of Uncaptured Recyclables from Single-Family Households

June, 2016

METHODOLOGY

Waste Studies Method

To examine the composition of the waste generated in Tennessee, data on the breakdown of disposed material were found in reputable waste characterization reports that conducted physical waste sorts in other cities in the country. The most comprehensive report was that of the entire State of Illinois⁵⁴, while the other two studies looked at Montgomery County, Maryland⁵⁵ and Prince William County, Virginia⁵⁶. Given that no physical waste sorts are a part of this study’s scope, these reports were identified for use in this analysis of Tennessee’s waste stream.

In choosing these studies, there were a number of parameters considered. Each of these selected studies carried out their analysis between 2013 and 2015 (Table 1), which ensures the data reflected the current waste stream composition. All of these identified reports are from states that do not have deposits on beverage containers (non-deposit states), which is consistent for Tennessee as a state without a deposit system in place. Additionally, these studies were found to be robust and thorough in their analysis by extracting hundreds of samples at different times in the year from the generating sectors of residential and commercial as well as urban and rural settings (Table 1).

³ Illinois Commodity/Waste Generation and Characterization Study Update. (2015). Retrieved September 3, 2015, from <http://www.illinois.gov/dceo/whyillinois/KeyIndustries/Energy/Recycling/Documents/2015 Waste Characterization Update FINAL.pdf>

⁵⁵ Montgomery County Waste Characterization Study Summary of Results. (2013). Retrieved September 3, 2015, from <https://www.montgomerycountymd.gov/sws/resources/files/studies/waste-composition-study-130726.pdf>

⁵⁶ Prince William County Virginia Waste Characterization Study Summary of 2013-2014 Results. (2014). <http://gbbinc.com/gbbwp2013/wp-content/uploads/2013/10/PWC-Waste-Characterization-Final-Report.pdf>



The collected samples from the waste sorts were separated into various material categories. Every report had slightly different ways of listing the categories. As a result, categories and subcategories were compared and reconfigured where necessary to create consistency amongst the columns of compiled percentages for this analysis. From the greater list of all materials (recyclable and non-recyclable) found in the waste stream, SERDC identified a list of the target recyclables that are the more commonly accepted items in a municipal recycling program (Table 2).

After confirming the list of recyclables from the broader categories, the next step involved extracting the percentages of these recyclable materials found in the waste stream from the dozens of samples that were examined in each of these reports. Only residentially sourced samples were used in this compilation. Each individual report already contained a mean average for the different types of recyclable materials as well as non-recyclable materials from the numerous collected samples. For this analysis, the percentages of recyclables were recorded and averaged amongst all the residential data in the reports to provide a thorough estimation. See bottom highlighted row in Table 3 for the average percentages used after incorporating the data from the selected residential samples.

After going through the necessary steps to extract the data for waste generated by single-family households, the aforementioned residential average percentages for recyclables (bottom row in Table 3) found in the waste stream were applied to this data. Applying these averages by commodity offered more insight into the levels of lost recyclables generated in these households.. See Chart 1 below for the breakdown of estimated recyclable material by commodity type from this method's estimations. The aggregate of all recyclable materials under this method is 1,448,188,286 pounds or 724,094 tons.

Chart 1. Waste Studies Method – Estimation of Uncaptured Recyclables

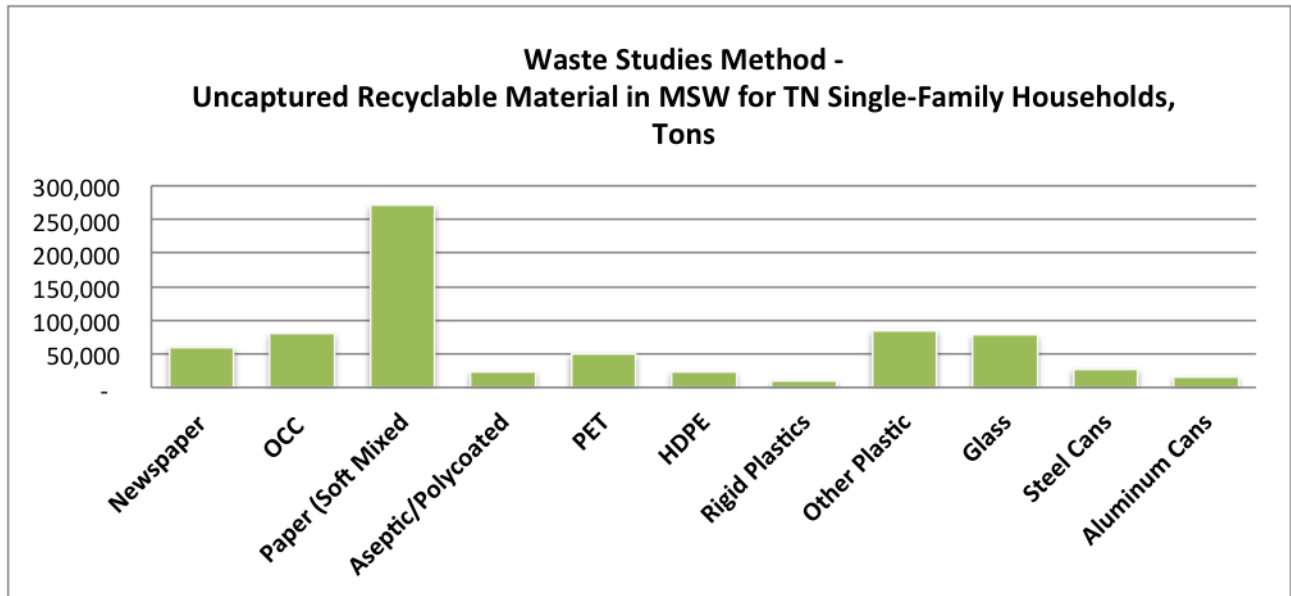
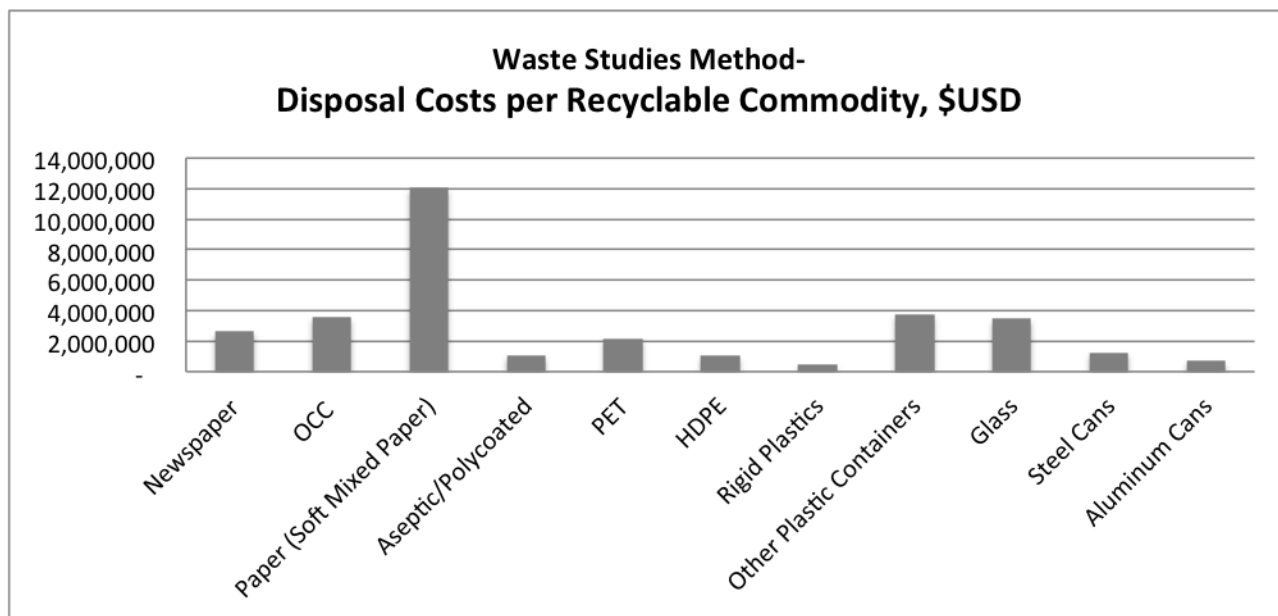


Chart 2. Disposal Costs of Recyclable Materials – Waste Studies Method

The chart below describes the disposal costs associated with the recyclable material estimated in the waste stream. A regional average tipping fee of \$44.46/ton was identified for the southeast region from the Environmental Research Education Foundation (EREF) that released an analysis in March 2016.⁵⁷ This average was used to calculate the costs to dispose of the recyclable material.



⁵⁷ Environmental Research Education Foundation (EREF) Analysis on Average Tip Fees. Retrieved on May 19, 2016. <http://www.wastedive.com/news/eref-study-west-coast-reports-highest-average-tipping-fees-other-regions/415294/>

Graphic 1. Visual Description of Steps in Waste Studies Method

As a visual aide, this graphic serves to illustrate the steps involved from using the set of waste studies to determine the amount of recyclables in the MSW from single-family households in Tennessee.

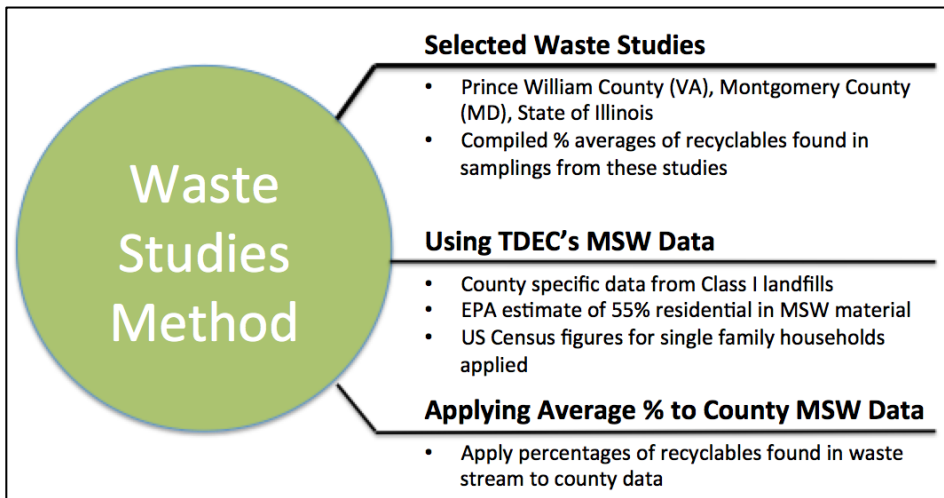


Table 1. Summary of Selected Waste Characterization Studies

The chart below describes the parameters from each of the waste studies used in this analysis.

List of Waste Reports	Publi sh Date of Study	Type of Waste Samplin g	Total # of Sample s Collect ed	Sates of Samples	Size of Sampl es	Study’s Main Objective
Montgomery County, Maryland	2013	4 sampling events at county transfer station	300	October, January, April, June of 2013	200 Lbs. sample sizes from loads	Determine composition of MSW stream
Prince William County, Virginia	2014	2 week long sampling events at county landfill	100	November 2013 and May of 2014	200 Lbs. sample sizes from loads	Estimate types and quantities of recyclable and compostable waste in residential stream
State of Illinois	2015	28 sampling events at 27 solid waste facilities located throughout Illinois	263	31 days between September 2014 and December 2014	200 to 300 Lbs. sample sizes	Supporting efforts to increase the quantity of materials recycled or composted in Illinois

Table 2. Categories and Subcategory Groupings from Waste Characterization Report

This table describes the broader recyclable categories identified from the waste studies as well as the subcategory materials used for this analysis.

Paper	Plastic	Glass	Metal
Newspaper	#1 PET Bottles/Jars, Other PET Containers	Recyclable Glass Bottles & Jars	Aluminum Beverage Containers
Uncoated OCC/Kraft	#2 HDPE Bottles/Jars (Clear, Color), Other HDPE Containers		Ferrous Containers (Tin Cans)
Aseptic / Poly-coated cartons	#3-#7 Bottles		
Mixed Paper - High Grade Office Paper, Boxboard, Paperboard, Magazines, Phone Books, Other Recyclable Paper	Other Plastics – Recyclable containers and tubs, other rigid plastics		

Table 3. Percentages of Recyclables Found in Waste Studies – Residential Samples Only

The table below shows the categories and subcategories of recyclable materials and their respective composition percentages that were taken from the three waste studies. These categories were identified as focus materials in the residential waste stream as they are the more common items collected for recycling from households. The subcategories below are self-explanatory except for the ‘Other Plastics Containers,’ which includes other recyclable containers/tubs and other rigid plastics.

List of Waste Characterization Studies	Type of Location	Paper				Plastic				Glass	Metal	
		News paper	Un-coated OCC/ Kraft	Mixed Paper	Aseptic /Poly-coated cartons	#1 PET Bottles/Jars, Other PET Containers	#2 HDPE Bottles/Jar (Clear, Color), Other HDPE Containers	#3-#7 Bottles	Other Plastics Containers	Recycl-able Glass Bottles & Jars	Aluminum Beverage Containers	Ferrous Containers (Tin Cans)
Montgomery County, Maryland	Urban	2.1%	1.00%	10.40%	1.3%	1.50%	0.60%	0.10%	2.90%	1.40%	0.40%	0.90%
Montgomery County, Maryland	Urban	2.2%	1.20%	10.10%	1.9%	1.80%	0.70%	0.10%	3.20%	2.40%	0.40%	1.00%
Montgomery County, Maryland	Urban	2.6%	1.30%	10.10%	2.1%	1.80%	0.60%	0.10%	3.20%	1.60%	0.50%	0.80%
Montgomery County, Maryland	Urban	2.9%	2.30%	11.00%	1.0%	2.70%	1.00%	0.10%	3.50%	4.50%	0.70%	1.50%
Prince William County, Virginia	Urban	2.1%	2.70%	8.40%	0.8%	1.50%	0.90%	0.10%	3.70%	1.80%	0.50%	0.80%
Prince William County, Virginia	Urban	1.7%	6.80%	10.50%	0.6%	2.50%	1.30%	0.10%	4.10%	3.80%	0.80%	0.90%
State of Illinois	Urban & Rural	2.4%	4.30%	10.20%	0.20%	1.70%	0.90%	0.90%	2.80%	3.60%	0.70%	1.00%
State of Illinois	Urban	2.2%	4.30%	9.00%	0.20%	1.50%	0.90%	0.90%	2.60%	4.20%	0.60%	1.20%
State of Illinois	Rural	2.8%	4.20%	15.00%	0.20%	2.20%	1.30%	1.20%	3.60%	3.90%	1.00%	1.60%
Average for Residential		2.33%	3.12%	10.52%	0.92%	1.91%	0.91%	0.40%	3.29%	3.02%	0.62%	1.08%

MARKET VALUE OF RECYCLABLE COMMODITIES

Through research and communication with industry experts⁵⁸, the commodity index chosen for this analysis was from Recycling Markets Limited (RML). The RML pricing index provided expansive historical data that shows the pricing fluctuations from previous years. SERDC extracted the necessary data from the past three years to produce a pricing average that accounts for these fluctuations, providing a better sense on what the recyclable commodities have been worth over a longer span of time. The southeast regional average was selected for Tennessee and the first published prices from each month were the ones recorded for this analysis.

Despite its high recyclability, glass remains a commodity that has a weaker economic gain with respect to its value in the recycling market. Glass was assigned a price of \$0/pound due to its current pricing position. Also, aseptic and poly-coated cartons are becoming more accepted in recycling programs although it depends on the local MRF's ability to process this type of layered material. The pricing index did not include a current regional price or historical pricing data for this material, which resulted in assigning aseptic and poly-coated cartons a \$0/pound value. The Institute of Scrap Recycling Industries (ISRI) has listed a bale spec for "aseptic packaging and gable-top cartons"⁵⁹ but this commodity continues to grow as a material that is acceptable in recycling programs.

In Table 5 below there is a column that shows the percent of disposed waste that indicates how much of the recycled material is part of the waste stream. These are the average percentages that were taken from the waste studies. Table 6 includes a similar column but incorporates percentages from a single-stream composition, which is important to note because the composition used in these two methods varies, which affects the amount and market value of the various listed recyclables.

Due to the wide range of recyclable plastics, the Association of Plastic Recyclers provided technical support on the composition of plastic pricing for this analysis. The suggested breakdown of this commodity pricing was as follows:

PET – used PET (baled, picked up)

HDPE – used 52% of the colored HDPE pricing and 48% of the natural HDPE pricing (percentages are according to the 2014 National Postconsumer Plastics Bottle Recycling Report⁶⁰)

Rigid Plastics – used 30% colored HDPE, 26% PP Postconsumer, 44% PET

⁵⁸ Cornell, Dave (Association of Plastic Recyclers). "Re: question on commodity prices for plastics." Message in response to Meredith Leahy from Dave Cornell. 28 March 2016. E-mail.

⁵⁹ "Scrap Specifications Circular" (2016). <http://www.isri.org/docs/default-source/commodities/specupdate.pdf>

⁶⁰ "2014 United States National Postconsumer Plastics Bottle Recycling Report" (2014).

<https://plastics.americanchemistry.com/Education-Resources/Publications/2014-National-Post-Consumer-Plastics-Bottle-Recycling-Report.pdf>



Other Plastic Containers – used Comingled #1-#7

Table 5. Commodity Values of Lost Recyclables – Waste Studies Method

Focused Material	3 Year Southeast Regional Average \$/lb.	Amount Available to Recycle in SF Households, Lbs.	% of Disposed Waste	Market Value
Newspaper	\$0.03	119,995,687	2.3%	\$3,149,887
OCC	\$0.05	160,680,919	3.1%	\$8,164,328
Paper (Soft Mixed Paper)	\$0.03	541,783,100	10.5%	\$14,551,269
Aseptic/Poly-coated Cartons	\$0	47,380,271	0.9%	\$0
PET	\$0.15	98,365,563	1.9%	\$14,741,808
HDPE	\$0.30	46,865,268	0.9%	\$13,958,503
Rigid Plastics	\$0.17	20,600,118	0.4%	\$3,591,655
Other Plastic Containers	\$0.04	169,435,969	3.3%	\$6,548,471
Glass	\$0	155,530,890	3.0%	\$0
Steel Cans	\$0.03	55,620,318	1.1%	\$1,783,233
Aluminum Cans	\$0.51	31,930,183	0.6%	\$16,180,836
Total:		1,448,188,286	28.1%	\$82,669,989

Table 7. Varying Capture Rates

As with any projection, it’s beneficial to consider the incremental steps toward reaching a long range goal. The information below shows the amount of material that could be captured based on the incremental percentages.

Estimated Recyclables Not Captured	Potential Capture Rates			
	25%	50%	75%	100%
Waste Studies Method (tons)	181,024	362,047	543,071	724,094

The Economic Impact of the Recycling Industry in Alabama

THE ECONOMIC IMPACT OF THE

RECYCLING INDUSTRY

IN

ALABAMA

Prepared for the Southeast Recycling Development Council

Frank Hefner

June 30, 2016

The Economic Impact of Recycling

Alabama

Summary of Results

2015

Recycling = Jobs

Total Economic Impact = 84,412

Recycling = Income

Total Economic Impact = \$4.5 Billion

Recycling = Increased Economic Activity

Total Economic Impact = \$19.4 Billion

Recycling = Tax Revenues

State and Local Taxes = \$765 Million

Introduction

In order to better understand the economic potential of recycling to the state of Alabama, the Southeast Recycling Development Council commissioned this study to measure the economic impact of recycling. This study follows a similar analysis conducted in 2014 in South Carolina sponsored by the S.C. Department of Health and Environmental Control in conjunction with the S.C. Department of Commerce.

“That recycling is beneficial for the environment is a virtually uncontested proposition. What is becoming increasingly more obvious is that recycling contributes to the economic health of a state's economy.”

- Frank Hefner and Calvin Blackwell, College of Charleston⁶¹

There are a number of methodological issues in analyzing the recycling industry. Unlike industries such as car manufacturing, which have a unique and identifiable designation in the North American Industry Classification System, recycling is not so easily identified. There is no one category that captures the variety of activities that fall under recycling. Researchers have been confronted with similar problems in analyzing other amorphous industries, such as “tourism” and “retirement.” Much like recycling, there is no well-defined category for tourism. The economic activities associated with tourism, like recycling, are diffuse and spread across the entire region. The most common method to deal with these problems is to combine survey data with an impact model. This is the method we used in this research.

Because of the ambiguity in defining the industry and the usual problems with surveys, comparisons of studies done in other states are not easily made. For example, Alabama in 2012 conducted a study that looked only at municipal solid waste.⁶² A study in Connecticut in 2012 found that recycling created 4,860 jobs and contributed \$746 million in economic activity in the state.⁶³ The direct impact on jobs was estimated to be 2,785, which implies a multiplier of 1.75 for jobs. The study included public

⁶¹ Hefner, Frank, and Calvin Blackwell. (2007) “The Economic Impact of the Recycling Industry in South Carolina,” *Southern Business Review*, 32 (2), 33-41

⁶² *Economic Impact of Recycling in Alabama and Opportunities for Growth*, Alabama Department of Environmental Management, June 2010.

⁶³ *The Economic Impact on Connecticut from Recycling Activity*, prepared by the Connecticut Economic Resource Center, November 2012.

curbside activities as part of the recycling industry. The Iowa Department of Natural Resources estimated the impact of recycling in 2005 using a survey.⁶⁴ Approximately 1,365 surveys were mailed with a 15% response rate. It was estimated that 15,684 jobs were directly related to recycling. This generated a total impact of 34,162 jobs in Iowa, which implies a multiplier of 2.18. A study done in Illinois study included public and private collection of recycling. They identified 958 contacts for a survey, sent 668 surveys, and received 100 returned (15% rate). Municipal residential curbside and drop-off collection amounted to 308 establishments, 665 employees, \$27,981,000 in payroll. Private residential and commercial collection was 239 establishments, 1,215 employees with a payroll of \$60,859,000.

In the Illinois estimate they also include retail used merchandise sales (595 establishments). Used furniture, Goodwill industries, Play it Again Sports (used sporting equipment) etc. The data base we used was more in line with an industrial concept. The Illinois study estimated a direct impact of 40,000 jobs and a total job impact of 111,500. Labor income \$1.5 billion multiplies to \$3.6 billion. Total economic output is \$30.3 billion.⁶⁵ Northeast Recycling Council (NERC) found in 2009 that “Massachusetts is home to over 2000 recycling businesses that employ close to 14,000 people with a payroll approaching \$500 million annually.”⁶⁶ In their 2012 study they surveyed 138 firms. In their 2009 analysis they include municipal residential curbside and drop off collection (so it is private plus public). The study focused primarily on workforce needs in the industry.

Results

420 firms were identified as being in the recycling industry. Surveys were mailed to all 420. Twenty were returned as undeliverable. 64 surveys were completed. Data on 56 firms identified as recyclers were obtained from secondary data sources, such as Hoovers.

⁶⁴ *Economic Impacts of Recycling in Iowa*, Iowa Department of Natural Resources, December 2007.

⁶⁵ *2010 Recycling Economic Information Study Update for Illinois*, Nov. 2010, prepared by DSM Environmental under contract to Illinois Recycling Association.

⁶⁶ *Recycling and Jobs in Massachusetts*, March 2012.

Facility Information

Type	Per Cent
Hauler	6.7
Manufacturer	47.5
Broker	3.3
Processor	50.0
Remanufacturer	1.7
Reuse	5.0

One of the characteristics of this industry is that firms are often multi-activity firms. A firm could be both a hauler and a manufacturer. We were able to identify the type of facility in 120 cases. 14 firms were multi-types. Thus the total adds to more than 100%. 12% of the firms engaged in multiple activities.

Materials

Material	Per Cent
Bio-mass	7
Metals	69
Petroleum	8
Glass	4
Electronics	16
Organics	0
Rubber	2
Paper	29
Construction – Demolition	1
Textiles	3
Miscellaneous	1
Plastics	22

69% of the firms indicate that they recycle plastics. Since some firms recycle more than one type material, the percentages add to more than 100%. 25% report they process more than one material.

Employment

A number of firms engage in recycling but recycling is one part of their business activities. The survey asked “Percentage of your business engaged in recycling.” Responses ranged from 100% to 5%.

The average number of employees in our sample of firms was 150. The range was from 2700 to 1. The median was 30.

Of the firms in the survey sample, the mean number of employees engaged in recycling is 81 employees, with a median of 20. The range was from 1449 to 1.

62% of the business activity in the surveyed firms was attributable to recycling. In terms of measuring impact to the state, we utilize the estimate of employees engaged in recycling.

Outlook

In response to the question:” Do you plan to invest in more plant capacity, equipment, or land in the next five years for recycling?” 20% of the responding indicated they have expansion plans in place, while 30% indicated they do not.

In response to “Is recycling a growing industry?” 33% responded in the affirmative, while 18% responded negatively. Of those believing the industry is growing the estimate of the growth rate ranged from 25% to 2%. The average growth rate was 7% annually.

The response the question “Estimate what percent of your feedstock is made of recycled material?” (32 responses out of the 97 surveys returned) follows:

5% responded none

7% responded 0-25%

1% responded 26-50%

4% responded 51-75%

15% responded 76-100%

Multiplier Concept

The survey results provide information on what is termed a “**direct impact.**” The direct impact is the initial spending or job generated by the firm engaged in recycling activities. In order to understand the complete economic impact of the recycling industry, we must also consider what are called “ripple effects.” Ripple effects comprise indirect and induced impacts. The concept is fairly straight forward and often analysts refer to the idea of dropping a stone in a pond. The initial splash is the direct impact. The accompanying ripples are the “multiplier effects.”

Consider a recycling facility. The plant hires workers and pays a payroll. The operations of the plant are the direct expenditures. In the process of its operations the firm may purchase goods and services from other companies. Those purchases are termed the “**indirect impacts.**” For example, a recyclable materials processor purchases machinery from machinery manufacturers who in turn purchase raw materials, parts, and services from other industries. Further, the recyclable materials processor provides processed feedstock to other manufacturers who then sell their product. The employees in turn spend their paychecks, which in turn generates additional impacts. These impacts are termed “**induced impacts.**”

Multiplier Effects Example

As an example, consider a firm that in the Waste Management and Remediation Services Sector that employs 100 workers in Alabama.

Economic Impact of Typical Firm Waste Management and Remediation Services 100 Employees

Impact Type	Employment	Labor Income	Output
Direct Effect	100	\$6,620,305	\$20,785,235
Indirect Effect	56	\$2,669,831	\$7,740,815
Induced Effect	52	\$2,037,500	\$6,721,618
Total Effect	208	\$11,327,635	\$35,247,668

For every 100 employees working in the Waste Management and Remediation Sector an additional 108 jobs are generated through the indirect and the induced effects, resulting in a total of 208 jobs. Labor income paid total \$11,327,635. The total economic activity resulting from the direct output and all of the ripple effects amounts to \$35,247,668.

Other sectors that IMPLAN identifies as being impacted by this firm include food services and drinking places, employment services, real estate, physicians, dentists, and wholesale and retail trade. This is what is meant by the “ripple effect.”

In our sample, a total of 96 firms were identified by the NAICS code. Each firm engaged in recycling in some form. The NAICS codes were matched to IMPLAN for proper input into the model. The

96 firms employed a total of 7772 employees. This represents their direct impact. The total impact in Alabama of these identified firms is 20,121 jobs, which includes the indirect and induced effects. Total labor income is estimated to be \$1,077,690,877. Total economic activity in the state is \$4,634,109,703. Total state and local taxes collected as a result of this economic activity are estimated to be \$182,344,974.

Total Economic Impact of 96 Firms in Sample

Impact Type	Employment	Labor Income	Output
Direct Effect	7723	\$501,324,733	\$2,863,596,533
Indirect Effect	7435	\$381,542,438	\$1,127,818,740
Induced Effect	4963	\$194,823,707	\$642,694,429
Total Effect	20121	\$1,077,690,877	\$4,634,109,703

Total Economic Impact of Recycling Activity in Alabama

Although the average number of employees in the sample was 150 per firm, not all of these are engaged in recycling. The average number of jobs per firm attributable to recycling activities was estimated to be 81. In order to capture the impact of recycling efforts in Alabama, the jobs attributable to recycling was used. This implies a direct impact of 32,400 jobs. Using the estimate of the average employment in firms associated with recycling we estimate the following total impacts in Alabama.

Estimated Impact of Recycling in Alabama

Impact Type	Employment	Labor Income	Output	State and Local Taxes
Total	84,412	\$4,521,194,408	\$19,441,299,285	\$764,984,741

Distribution of Industries Engaged in Recycling

Fiber, Yarn, and Thread Mills
Carpet and Rug Mills
All Other Miscellaneous Textile Product Mills
Sawmills
Pulp Mills
Paper (Except Newsprint) Mills
Paperboard Mills
Corrugated and Solid Fiber Box Manufacturing
Paper Bag and Coated and Treated Paper Manufacturing
All Other Converted Paper Product Manufacturing
Custom Compounding of Purchased Resins
Polystyrene Foam Product Manufacturing
All Other Plastics Product Manufacturing
Iron and Steel Mills and Ferroalloy Manufacturing
Iron and Steel Mills
Iron and Steel Pipe and Tube Manufacturing from Purchased Steel
Secondary Smelting and Alloying of Aluminum
Iron Foundries
Steel Foundries
Ornamental and Architectural Metal Work Manufacturing
Metal Heat Treating
Computer Terminal and Other Computer Peripheral Equipment Manufacturing
Motor Vehicle Body Manufacturing
Motor Vehicle Seating and Interior Trim Manufacturing
All Other Motor Vehicle Parts Manufacturing
Motor Vehicle Parts (Used) Merchant Wholesalers
Brick, Stone, and Related Construction Material Merchant Wholesalers
Metal Service Centers and Other Metal Merchant Wholesalers
Recyclable Material Merchant Wholesalers
All Other Miscellaneous Store Retailers
Computer Systems Design Services
Hazardous Waste Treatment and Disposal
Solid Waste Landfill
Materials Recovery Facilities
Civic and Social Organizations (non- profit community drop)

APPENDIX A

THE INPUT - OUTPUT MODEL

This section presents a brief description of how regional input-output models are used to estimate economic impacts. Much of the material included is found in a more complete exposition written by Hefner (1997).⁶⁷

The basis for impact analysis is the input-output (I-O) table. The table is constructed with data on detailed inter-industry flows throughout an economy and information on both final demands and total output. An I-O table is fundamentally an accounting relationship for an entire economy (national, state, or sub-state), with each industry represented as both a column and a row in a matrix. In simple terms, it is a set of recipes for production in a given economy. The table provides data on industry demands and supplies to all industries. The multipliers that are used in measuring economic impacts are calculated from the I-O table.

A simple numerical example containing hypothetical data of a two sector economy input-output table is presented in Figure 1.

Figure 1.

Hypothetical Input - Output Table

	Con	Manu	Final Demand	Total Output
Con	200	100	700	1000
Manu	400	500	1100	2000

⁶⁷Hefner, Frank (1997). "Using Input-Output Models to Measure Local Economic Impacts." *International Journal of Public Administration*, 20 (8&9): 1469-1487.

In this example, the manufacturing sector delivers to final demand \$1100 worth of goods. Final demand is the finished product that is used by a consumer. In addition, this sector provided \$400 of output to the construction sector and \$500 to itself. The total output of manufacturing is the row total, or \$2,000. From the column of manufacturing data, it is apparent that to produce the \$1100 of final goods, the manufacturing sector used \$500 worth of its own output and \$100 of output from the construction sector. These demands for goods to be used in the production of goods delivered to final demand are termed intermediate demands.

Wassily Leontief, 1973 Nobel Prize winner in economics, developed the mathematical technique to calculate what is now called the Leontief Inverse, which posits that changes in one economic sector cause a ripple effect into other sectors of the economy. The inverse allows researchers to determine the total effects of a change in final demand. For example, in our simple model above the manufacturing sector utilizes inputs from both its own sector and construction. Construction, in turn, to meet this increase in demand, uses inputs from manufacturing. The Leontief inverse is a mathematical tool that calculates the total round by round changes in demands. The direct impact is the initial change in final demand. The total intermediate demands (the supplier chain) are the indirect impacts. By adding to this simple model a row for payments to labor by the firm (wages) and a column of expenditure patterns (the marginal propensity to consume each type of product), the multipliers derived from the Leontief inverse will incorporate the direct, indirect, and induced impacts. The induced impacts are additional expenditures resulting from increased earnings by local residents as a result of the increase in final demand.

Term	Definition
Economic activity	Sales of firms within the region.
Jobs	The number of jobs in the region supported by the economic activity associated with the economic activity. IMPLAN jobs include all full-time, part time, and temporary positions. Job estimates are not full time equivalents, but include part time positions. Seasonal jobs are adjusted to annual equivalents, thus 1 job lasting 12 months = 2 jobs lasting 6 months each = 3 jobs lasting 4 months each.
Income	Labor income, including wages and salaries, payroll benefits and incomes of sole proprietors.
Direct effects	Direct effects are the initial changes in sales, income and jobs in those businesses or agencies that directly receive the spending directly. This is the initial impact.
Indirect effects	The impact of local industries buying goods and services from other local industries. The cycle of spending works its way backward through the supply chain until all money leaks from the local economy.
Induced effects	Changes in economic activity in the region resulting from household spending of income earned through a direct or indirect effect. For example, employees in a recycling facility live in the region and spend their incomes on housing, groceries, education, clothing and other goods and services.
Total Output	Sum of direct, indirect and induced effects. <ul style="list-style-type: none"> ▪ Direct effects accrue largely to recycling-related businesses in the area ▪ Indirect effects accrue to a broader set of businesses that serve these firms. ▪ Induced effects are distributed widely across a variety of local businesses that provide goods and services to households in the region.
Multipliers	Multipliers capture the size of the total effects relative to the direct effects.

APPENDIX B

IMPLAN

In the mid-1970s, the USDA Forest Service developed IMPLAN (Impact Analysis for Planning) for community impact analysis. IMPLAN is a regional economic impact model. The current IMPLAN input-output database and model is maintained and sold by MIG, Inc. (Minnesota IMPLAN Group). All economic impact models use data developed by the U.S. Department of Commerce and follow the methodology described above. According to the USDA, Natural Resources Conservation Service, over 1,500 clients across the country use the IMPLAN model making the results acceptable in inter-agency analysis within the government.⁶⁸ IMPLAN users range from federal, state, and local governments, universities, and private companies. In South Carolina the model is used by university researchers at Clemson, the University of South Carolina, Coastal Carolina University, and The Citadel.

In 2013, MIG was purchased by IMPLAN Group LLC and relocated from Minnesota to Huntersville, N.C., just north of Charlotte.

IMPLAN Group LLC, IMPLAN System (data and software), 16905 Northcross Dr., Suite 120, Huntersville, NC 28078 www.IMPLAN.com

⁶⁸ <http://www.economics.nrcs.usda.gov/technical/implan/implanmodel.html>, August 21, 2009.

APPENDIX C

AUTHOR

Frank Hefner, Ph. D., is a Professor of Economics and director of the Office of Economic Analysis at the College of Charleston. He received his B.A. Degree in Economics from Rutgers College and his M.A. and Ph.D. Degrees from the University of Kansas. He taught at Washburn University in Topeka while he was a research assistant in the Institute for Policy and Social Research at the University of Kansas and at the University of South Carolina where he served as a research economist in the Division of Research. Dr. Hefner's research interests include regional economic development and forecasting. He participates in the Regional Advisory Committee of the S.C. Board of Economic Advisors. He is a past president of the Southern Regional Science Association. He has been quoted frequently in the press and has commented on economic conditions on local television and radio stations and before a number of organizations.

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