

FINAL REPORT



Feasibility Study for the Recycling Program

January 14, 2021





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RECYCLING FEASIBILITY STUDY

1. INTRODUCTION

MSW Consultants was engaged by the City of Charleston, WV (City), to perform a recycling program feasibility analysis (Study). The West Virginia Department of Environmental Protection (WV DEP) funded the Study through a Recycling Assistance Grant. Faced with high recyclables processing and transportation costs, the City commissioned this project to evaluate its residential recycling program and identify potential actions and strategies for improving the program's performance.

1.1 BACKGROUND

The City of Charleston is West Virginia's state capital and largest city, with a population of 46,536 residents¹. Charleston also serves as the County seat for Kanawha County, the most populated County in West Virginia. Figure 1-1 below shows the City of Charleston within Kanawha County's boundaries.

The City's Public Works Department provides weekly refuse, recyclables, and bulky item collections to approximately 18,000 households (in residential properties with 12 dwelling units or less) as well as scheduled dumpster collections to some 67 City facilities and institutional customers. Other commercial and institutional generators of solid waste obtain services from private haulers.

Charleston's curbside recycling program has undergone significant changes during the past six years, starting with the change in materials processors in 2014. Up until that point, the City delivered the materials to a recyclables processing facility owned and operated by the Kanawha County Solid Waste Authority (KCSWA). The KCSWA stopped accepting the City's recyclables in 2014 due in part to high operational costs. The recycling facility has since been demolished (the KCSWA continues to operate a public, source-separated drop-off center and a remote baling operation). In its place, the City responded by securing single stream recyclables processing capacity at the Raleigh County Solid Waste Authority's (RCSWA) recyclables processing facility in Beckley.

However, RCSWA's facility is a 60-mile one-way trip from Charleston, which increases transportation and labor costs and vehicle wear and tear. In addition, for the first time, the RCSWA is now charging the City a recyclables processing fee of \$175 per ton.

The City's curbside recycling program has also been beset by low participation and recyclables yields in recent years. A field study performed by City staff in 2015 found that just 19.5 percent of eligible households set out recyclables each week. From 2015 through 2019, Charleston collected an average of

Figure 1-1 Charleston & Kanawha County, WV



¹ 2019 U.S. Census Estimate

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650 tons of curbside recyclables per year or just over 70 pounds per household. Both the set-out and pounds per household collection metrics are far below national averages.

Finally, the City was forced to temporarily suspend curbside recycling in April 2020 due to the COVID-19 pandemic related closure of the RCSWA's facility. The City resumed services in late September. Due to the temporary suspension of the curbside recycling program, it was not possible for MSW Consultants to observe the single-stream collection system operating under normal conditions. Nonetheless, historical data and professional experience with other jurisdictions were sufficient to understand current recycling collection system performance.

1.2 PROJECT APPROACH

The project was organized into three key phases, including:

- ◆ **Phase 1 - System Inventory and Initial Observations:** This phase included the project initiation and kick-off meeting, as well as the inventory and baselining of the operational, financial, environmental, policy, and political attributes of Charleston's recycling program. It also offered some preliminary ideas for ways to evolve and improve the system.
- ◆ **Phase 2 – Definition and Analysis of Alternatives:** Phase 2 of the project included identification and assessment of alternatives for the City and compared the operational, financial, environmental, contractual, and risk positions of each one against the status quo.
- ◆ **Phase 3 – Reporting and Recommendations:** This report represents the final phase of the project and presents key findings.

It should be noted that the project also included supplemental meetings with members of the City Council's Environment and Recycling Committee. These meetings included two introductory meetings, each with three to four committee members present, as well as a presentation and meeting with the entire Committee on October 7, 2020. MSW Consultants also provided an update to the Committee at its December 9, 2020 meeting. While not in the initial project scope, MSW Consultants believes these meetings provided additional insights and perspectives into City policymakers' support for the recycling program.

1.3 SCOPE OF THE STUDY

It is important to note that this Study was focused on the recycling program, spanning collection, processing, and education. However, because municipal waste management systems necessarily integrate refuse collection and disposal, bulk waste collection and disposal, and potentially other collection programs, the approach to this Study included some attention to these other services. It was beyond the scope of the project to consider the entire sanitation system though, and primary analysis and the more detailed recommendations arising from the Study are focused on the recycling program.

2. EXISTING SYSTEM OVERVIEW

2.1 RECYCLING REGULATORY SUMMARY

2.1.1 STATE REQUIREMENTS

The West Virginia Recycling Act of 1989 established a statewide goal of reducing per capita solid waste disposal by 50 percent by 2010, using 1991 as the base year. The act requires municipalities with more than 10,000 residents to provide curbside recyclables collections for its residents, while local Solid Waste Authorities (SWA) are mandated to develop recycling plans and incorporate them into their Comprehensive Litter and Solid Waste Control Plans.

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The state’s requirements are presented in West Virginia Code §22-15A-18. Charleston is one of the 14 cities in the state required to provide curbside recyclables collections. Key state requirements for mandated municipalities and counties are summarized in Table 2-1 below.

Table 2-1 State Recycling Requirements

§22-15A-18	
Subsection	Description
(b) (1)	Adoption of an ordinance that mandates residents, institutions, and businesses separate at least three recyclable materials from refuse
(b) (2)	A scheduled recyclables collection day of at least once per month
(b) (3)	Municipalities are encouraged, to the maximum extent possible, to provide for recyclables collection at the same frequency as refuse collection
(b) (4)	Provisions to ensure compliance such as incentives or penalties
(b) (5)	A comprehensive public information and education program that notifies all participants of the benefits of recycling, program features and requirements, system operations, municipal responsibilities, incentives, and penalties (for non-compliance)
(b) (6)	Consultation with a county or regional solid waste authority to avoid duplication, ensure coordination, and maximize recycling markets
(d)	Recyclable materials shall include (but not be limited to): aluminum and steel cans, glass, paper, or other materials specified

Note that State Code, in §22-15A-17, also requires that each county or regional solid waste authority develop a “comprehensive litter and solid waste control plan,” as well as a recycling plan. The City falls under the KCSWA’s recycling plan, the most recent of which was approved by the West Virginia Solid Waste Management Board (SWMB) in October 2016.

Oversight and regulation of recycling efforts across the state and at the local level are generally performed by three state agencies, including:

- ◆ **The Solid Waste Management Board (SWMB)**, which primarily interfaces with the state’s 50 local solid waste authorities, including grants issuance and administration
- ◆ **The Department of Environmental Protection (DEP)**, which promulgates rules and manages the Rehabilitation Environmental Action Plan (REAP) program and the WV Covered Electronic Device Takeback program and grants
- ◆ **The Public Service Commission (PSC)** which regulates solid waste tipping fees

Determining the success of West Virginia’s recycling requirements has been challenging, according to the SWMB. While permitted solid waste facilities, mandated municipalities, and the state’s solid waste authorities do report tonnages to the SWMB, which are published in the every-other-year update to the West Virginia Solid Waste Management Plan, there are no reporting requirements for private recyclers.

2.1.2 COUNTY REQUIREMENTS

Kanawha County adopted a recycling ordinance in 1992, which mirrors requirements as presented by West Virginia Code §22-15A-18. Kanawha County receives state grant monies for the WV Covered Electronic Device Takeback program in order to support e-waste diversion events but does not appear to have a role in developing and promoting other recycling efforts.

2.1.3 CHARLESTON’S SOLID WASTE CODE

Chapter 98 of the Code of Charleston addresses solid waste and recycling. A summary of recycling requirements in the code is provided below:

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- ◆ The City’s annual solid waste service charges are identified in Division 2, Section 98-71, Subsection (b). Charges are detailed below in Table 2-2.

Table 2-2 Charleston Refuse & Recycling Charges

Customer Class	Monthly Rate	Annual Rate
Residential	\$18.00	\$216.00
Non-residential:		
<i>Curbside</i>	\$25.00	\$300.00
<i>Dumpster</i>	\$40.00	\$480.00

- ◆ Recyclables *separation* requirements are primarily identified in Division 4, Section 98-121, Subsection (a). Recyclables referenced include aluminum, steel and bi-metal cans, PET (#1) and HDPE (#2) plastics, mixed office paper, newspaper, magazines, junk mail, boxboard, and corrugated cardboard. Section 98-121 references the West Virginia Code, Chapter 22, Article 15A, which requires mandatory separation of at least three recyclables. The State Code grants the City Administrator the ability to designate the program recyclables.
- ◆ Subsections (d) and (e) also require commercial and institutional establishments to separate at least three materials for recycling. Subsection (d) further requires that “community activities” such as regattas, fairs, bazaars, and other events separate recyclables.
- ◆ Recyclables *collection* requirements are specified in Section 98-122.
- ◆ Yard waste requirements are spelled out in Division 5, Section 98-151. The section specifies that yard waste is to be set out for collection in clear bags provided by the City. Limbs and brush can be set out for chipping and, at certain designated times, leaves are permitted to be piled at the curb.

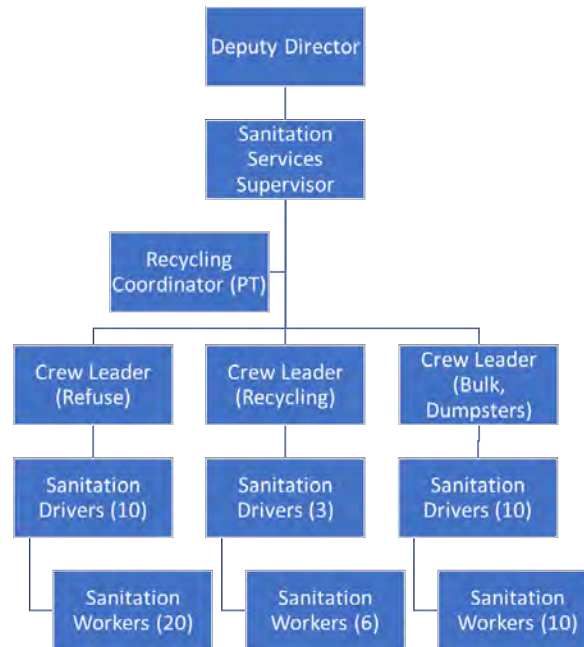
The implications of the current code will be addressed throughout the report.

2.2 REFUSE AND RECYCLING COLLECTION SERVICES

2.2.1 ORGANIZATION

Refuse and recycling services are provided by crews within Charleston’s Public Works Department (PWD). Other key lines of business for the PWD include street maintenance, equipment maintenance, and management of public grounds and facilities. The refuse and recycling operation has an FY 2021 staffing level of 66 positions and operates 34 collection vehicles. The adopted FY 2021 operating budget is just under \$3.3 million, and planned capital expenditures, which vary from year-to-year based on equipment needs is, \$515,000. The refuse and recycling operation’s organization chart is shown below in Figure 2-1.

Figure 2-1 Charleston Refuse Services Organization Chart



MSW Consultants spent parts of three days observing residential dispatch and collections in Charleston. The operations review results are contained in a PowerPoint presentation from the November working meeting, included in the report's appendix. Because many of these observations spanned beyond the recycling program, they are not provided in the body of this report. Selected details are included in the subsections below.

2.2.2 RECYCLABLES COLLECTIONS

The following materials are collected in Charleston's curbside recycling program:

- ◆ Mixed paper, including newspaper, magazines, office paper, boxboard, etc.
- ◆ Corrugated cardboard
- ◆ Aluminum and steel cans
- ◆ PET (#1) plastics including water, soda, and juice containers
- ◆ HDPE (#2) plastics including milk jugs, detergent bottles, shampoo bottles, etc.

It is noteworthy that glass bottles and jars are not currently included in the recycling program. Where end markets exist, glass is highly recyclable, and because it is heavy, it will contribute to a higher recycling rate. However, its density also makes it expensive to transport to market, and the market price even for very clean glass is low (as is noted later).

Recyclables are collected weekly from personal containers or in see-through plastic bags. Residents are instructed to clearly mark personal containers used for recycling, and the City makes downloadable recycling decals available on its website. While there are no limits on the amounts of recyclables that can be set out, containers or bags must be 48-gallons or less in volume and weigh less than 40 pounds.

Even though curbside recycling service had been suspended since April due to the COVID-19 outbreak at the RCSWA, MSW Consultants was able to observe a handful of recycling set outs (materials placed out for collection either through habit or by residents who were unaware of the service suspension). City staff

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indicated the set outs observed and shown below in Figure 2-2 are representative of set outs when the program was operational. Note that collections staff indicated they received instructions to collect unbagged OCC with the trash, citing concerns over wet paper and cardboard apparently expressed by the RCSWA (even though there was no precipitation on the collection day observed).

Figure 2-2 Recycling Collection and Set-Outs



The City collects recyclables the same day as residents’ trash day, Tuesday through Friday. Recyclables are collected using 20 cubic-yard rear loading compactors and three-person crews. The City currently operates ten recycling routes, with two each on Tuesdays and Fridays and three on Wednesdays and Thursdays.

As it has been noted, recyclables are currently delivered to the RCSWA facility in Beckley. This is a round-trip of more than 120 miles, although recyclables are not hauled to the RCSWA directly from the daily routes. Instead, City recycling trucks generally collect and hold materials over the course of the week and deliver materials to RCSWA on Fridays. Most weeks result in three total deliveries to Beckley, although occasionally a fourth trip is required due to additional volumes.

2.2.3 RECYCLING COST OF SERVICE

The City does not currently track the cost of its recycling collection and processing services. Rather, solid waste management costs are accounted for in their entirety. MSW Consultants collaborated with the City to identify the equipment and labor resources, capital costs, and unit costs for the provision of residential curbside recycling collection. This estimate does not consider any allocated costs of management, administration, and City overhead that may reasonably be attributed to the recycling collection service, and therefore the estimate is of the direct costs only. The current direct cost estimate is shown in Table 2-3.

Table 2-3 Estimated Direct Cost of Recycling Program

Metric	Current
Set-Out Rate	25%
Number of Routes	3
Annualized Capital Cost	\$81,143
Vehicle O&M Cost	\$100,620
Labor Cost	\$583,331
Processing Cost	\$110,425
Total	\$875,519
Households	18,000
<i>Annual Cost per HH.</i>	<i>\$48.64</i>
<i>Monthly Cost per HH.</i>	<i>\$4.05</i>

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As shown, the direct cost per household is estimated to be just over \$4 per month. Recent competitively-bid recycling contracts for similar-sized cities in the Eastern U.S. have seen recycling costs per household in the \$6 to \$10 per month range (including collection and processing). This estimate suggests that Charleston residents are currently paying less than most other cities across the country that have a residential single-stream recycling program.

Another observation on the current cost is that all 18,000 households are paying this amount, while less than one-quarter of the households are setting out on any given day. It is important to note that an optimized recycling system will cost more, in both absolute terms and on a per-household basis, than the current system. This is because it will require more collection trucks and crews to capture the higher level of recycling participation, and a significantly greater amount of recyclable material will be collected. However, the City may be able to reduce the cost of other collection services as a prerequisite to making recycling program changes, which would offset the cost of the recycling program.

2.2.4 OTHER RESIDENTIAL COLLECTION SERVICES

Consistent with cities across the U.S., Charleston provides a full slate of curbside services to its residential sector:

- ◆ **Refuse:** Refuse collection is provided weekly to residential properties. Collections are performed four days per week on Tuesday through Friday. The City is divided up into 40 routes, with ten routes collected each day. Each route is serviced by a 20 cubic-yard rear loading compactor and a three-person crew. Collections are manual, with residents instructed to set out refuse in personal containers or bags. There are no limits to the number of refuse items that can be placed out by residents each week, an allowance that can delay the completion of daily routes. This is shown in Figure 2-3. Residential refuse is disposed at the City of Charleston Landfill, located on South Park Road. This is owned by the City but has been operated under contract by Waste Management since 1994. The landfill is approximately five miles from the City's public works yard.

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Figure 2-3 Unlimited Refuse Set-Outs



- ◆ **Yard Wastes:** Yard wastes and brush generated by residents is currently collected along with refuse. Residents are able to set yard waste and brush out loose for collections, a rule which can significantly impair collection productivity and increase the risk of accident or injury. An example of loose material set outs is shown in Figure 2-4 (which took five minutes to complete during our observations). The Public Works Department's public grounds business line previously operated a small yard waste processing operation, which has since been suspended, and the materials are now landfilled.

Figure 2-4 Loose Yard Waste Set Outs



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- ◆ **Bulky Wastes and Tires:** These materials are also collected from residences weekly using the Tuesday through Friday routing schedule, from a combination of stake-body trucks and rear loaders. The City used to require residents to schedule the pickup of these materials. Refuse and Recycling runs five bulky and two tire routes per day using two-person crews. MSW Consultants observed a number of households that set out an excessive number of bulky materials. Figure 2-5 below depicts two bulky set outs from the same property on the Thursday bulk route in South Hills.

Figure 2-5 Bulk Set-Outs



Standard Set Out



Excess Set Out

Figure 2-6 below shows the two primary collection truck types used for all curbside services. The City does not currently utilize any automated lifting technologies on the residential routes.

Figure 2-6 City Collection Vehicles



Rear loader Truck for Refuse and Recyclables



Stakebed Truck for Bulk Wastes

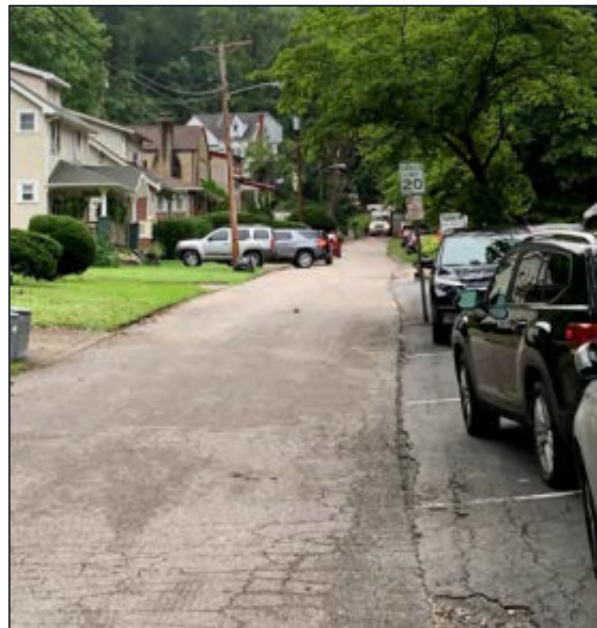
Charleston features numerous streets with narrow travel areas, steep grades, and dead ends. Figure 2-7 below shows a narrow road observed during the Wednesday collection route as well as a steep grade and dead-end street from the Tuesday route. For dead-end streets, the trucks back into the end (with help from crew members) and collect materials while travelling out.

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Figure 2-7 Charleston Topography



Narrow Streets



Steep Grades

Finally, it is noted that City crews collect refuse from three cubic-yard rear loading dumpsters from 67 City facilities and commercial properties. Some of these materials are collected during the Tuesday through Friday residential routes. The City's rear loader trucks are all equipped with tippers that allow rear load dumpsters to be serviced. A portion of these sites are collected separately on Mondays and Saturdays.

2.2.5 DAILY ROUTES

Charleston's daily collection routes by service, truck type, and crew size are detailed in Table 2-4. The primary observation from this table is that there are significantly more resources devoted to refuse and bulky waste collection than to recycling collection. This will be explored later in the report.

Table 2-4 City of Charleston Collection Routes

Service	Truck Type	Day of Week						Crew Size
		M	T	W	H	F	Sa	
Garbage	Rear load		10	10	10	10		3
Recycling	Rear load		2	3	3	2		3
Bulk	Stakebed		5	5	5	5		2
Garbage/Bulk Combined	Pack Rat Open Top		2	2	2	2		2
Scrap Metals	Stakebed		1	1	1	1		1
Tires	Stakebed		1	1	1	1		1
Dumpster (3 cy)	Rear load	1	*	*	*	*	1	3 (2 on Mon & Sat)
Totals		1	21	22	22	21	1	

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2.2.6 MATERIAL QUANTITIES

The City of Charleston has collected an annual average of 27,460 tons of refuse, recyclables, and other materials for the years 2015 through 2019. This includes tonnages from residential generators as well as the institutional and commercial dumpster routes. Because full-year statistics for 2020 are not yet available, as well as the impact to recycling and refuse tonnages that have resulted from April's COVID-19 related suspension of recycling collections, MSW Consultants has based much of this report's analysis on the five-year average tonnages.²

Table 2-5 below shows tons collected by material for calendar years 2015 through 2019, with six-month totals for 2020.

Table 2-5 MSW Tons Collected (CY 2015–2020)

Materials	Calendar Year					
	2015	2016	2017	2018	2019	2020 ⁽²⁾
Trash ⁽¹⁾	26,599	25,341	25,289	24,512	24,691	13,312
Yard Waste	1,510	1,104	1,271	1,057	1,841	1,202
Recyclables	604	798	669	640	631	97
White Goods	75	113	145	119	125	84
Tires	17	13	20	32	37	8
E-waste	32	15	-	-	-	-
Totals:	28,837	27,384	27,394	26,362	27,325	14,703

⁽¹⁾ Includes C/I dumpster collections

⁽²⁾ Totals through June 2020

Note that the reported tonnages in Table 2-5 include some refuse from the small number of commercial establishments collected with the dumpsters. Table 2-6 presents the residential portion of wastes by excluding the estimated quantity (562 tons) from the commercial establishments.

Table 2-6 Residential Waste Generation Estimate

Material	Annual Tons	Generation Rate Per Household (lbs.)
Total Refuse	24,691	N/A
<i>LESS Dumpster Refuse</i>	<i>(562)</i>	<i>N/A</i>
Residential Trash	24,129	2,681
Recyclables	631	70
Yard Waste	1,841	205
White Goods	125	14
Tires	37	4
Total Residential MSW	26,763	2,974

There are two noteworthy observations about this table. First, the residential MSW generation rate is higher than expected. This may be due to the current lack of set-out limits, which would provide an

² COVID-19 and its accompanying stay-at-home orders have generally resulted in increased residential solid waste generation across much of the U.S.

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incentive for residents to bring commercially-generated materials and/or renovation debris to their homes for set out (this will be discussed in Section 3 as well).

The second key observation is that the City is not capturing the expected fraction of curbside recyclables. Table 2-7 shows current data on the amount of curbside recyclables that are typically captured from residential recycling programs based on a national survey. Although the data in this table are for programs that include glass as a targeted material (unlike Charleston), the data show that 300 to 400 pounds of recyclables should be harvested from every household in a mature recycling program. This represents a four-fold increase over the City of Charleston’s current recovery level.

Table 2-7 Average Curbside Recycling Performance (Annual Pounds per Household)

Residential Recycling Container	Avg. Lbs./HH Collected	Median Lbs./ HH Collected	Number of Community Data Points
Bin	360.4	363.3	48
Bag	324.8	353.7	6
Cart	458.8	452.6	242
Programs Using a Combination of Bins & Carts	451.5	448.8	47

Source: The Recycling Partnership: “2020 State of Curbside Recycling” report

2.2.7 CONTRACTED SERVICES

The City’s primary solid waste services contracts for landfill disposal and recyclables processing are summarized in Table 2-8. The RCSWA contract is discussed later in this report.

Table 2-8 Summary of Waste Management Contracts

Vendor	Service	Term Ends
Waste Management (d/b/a Landfill Services of Charleston)	Operation of City of Charleston Landfill	February 15, 2029
Raleigh County Solid Waste Authority ⁽¹⁾	Recyclables Processing	June 30, 2021

⁽¹⁾ Memorandum of Understanding (MOU)

As shown, the City relies on a third party for accepting and processing its recyclables. The lack of multiple recyclables processing alternatives in the region is a major barrier to establishing a higher-performing recycling program and will be addressed in this report.

2.3 RECYCLABLES PROCESSING

2.3.1 RECYCLABLES MARKETS AND MARKET VALUES

Since the late 1980s, when state and local governments began enacting recycling and waste diversion goals, creating today’s municipal recycling system, global and U.S.-recovered materials markets have experienced market downturns and pricing spikes. From about 2000 until 2014 (with notable exception during the 2009 worldwide financial crisis from which markets quickly rebounded), U.S.-recovered materials prices enjoyed a long stretch of relatively stable pricing due to strong demand from the Republic of China. Indeed, this demand for U.S.-recovered materials, as well as inexpensive shipping costs, were a key driver in the development of single-stream recycling programs during that time period.

However, since the enactment of its Operation Green Fence in 2013, which imposed stricter materials quality standards and increased inspections of recovered materials imports, followed by implementation in 2018 of the National Sword Policy, China is no longer the major consumer of U.S. recyclables. Swings have been particularly volatile in the past three years, with the estimated value of curbside recyclables in the entire U.S. shrinking from more than \$5.5 billion in early 2017 to roughly \$2.8 billion at the end of

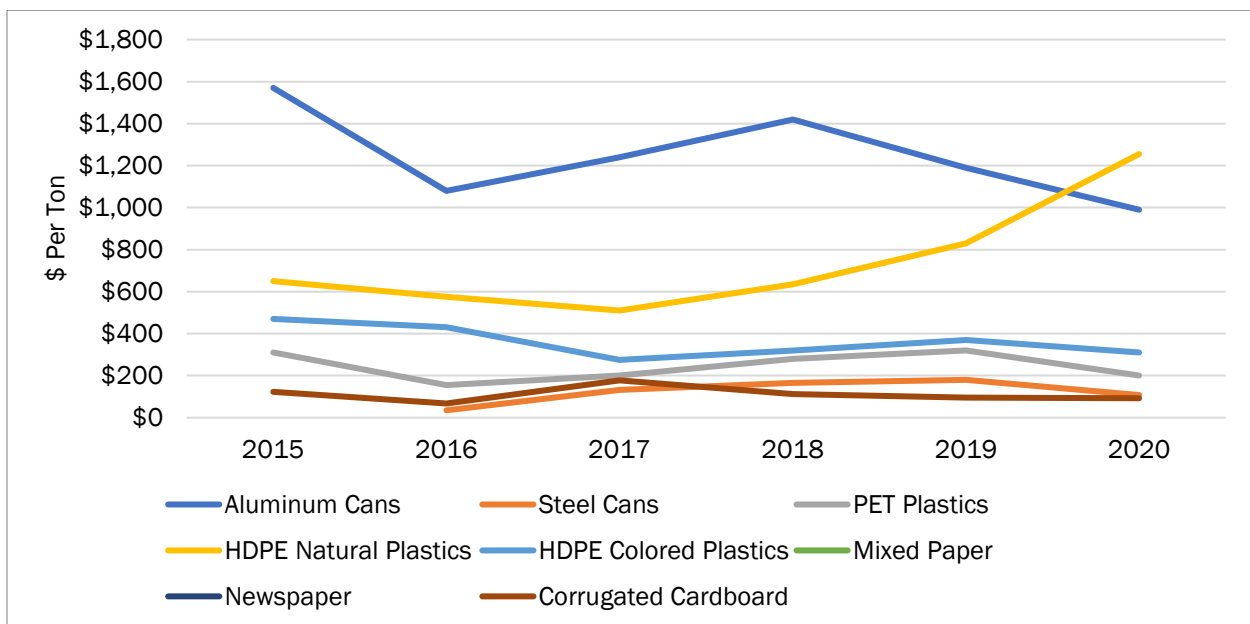
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2019, a drop of nearly 50 percent. Perhaps not surprisingly, recycling programs have struggled (and a few have been suspended) during down markets, despite flourishing in periods when market pricing was strong.

The loss of China as a primary end-market for U.S.-recovered materials has had a ripple effect on virtually every program in the U.S. Even programs that have been served primarily by domestic end-markets and materials buyers, such as those in West Virginia, have seen their material values plummet due to increased supply, shrinking demand, and the need to slow recyclables processing systems to remove program contaminants.

Figure 2-8 below demonstrates that the pricing for most primary recycling commodities has been volatile over the past decade. For large-volume commodities, such as corrugated containers, a value swing of a few dollars can impact operational costs significantly.

Figure 2-8 Recyclables Market Values



Source: Recyclingmarkets.net; NY. Region, high-price for Aluminum, Steel, PET, and HDPE; SE Region, high-price for RMP, ONP & OCC. Pricing through November 20, 2020.

2.3.2 RALEIGH COUNTY SOLID WASTE AUTHORITY (RCSWA)

As noted in this report’s introduction, Charleston has been delivering its curbside recyclables to the RCSWA’s recyclables processing facility in Beckley since late 2014. This move was precipitated by the operating issues and subsequent closure of the KCSWA recycling facility on Slack Street.

The RCSWA’s recycling facility is located on the Authority’s landfill property in Beckley and accepts curbside recyclables from Charleston, South Charleston, and Beckley – three of the 14 cities required to provide curbside recycling collections in West Virginia. It also accepts materials from other municipalities and institutional and commercial generators. The center processes mixed paper, cardboard, metal cans, and PET and HDPE plastics. Table 2-9 below shows tons of recyclables processed by RCSWA during the past five full calendar years.

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Table 2-9 Recyclables Managed by RCSWA

Year	Tons Processed
2015	2,172
2016	2,526
2017	2,624
2018	2,081
2019	2,429

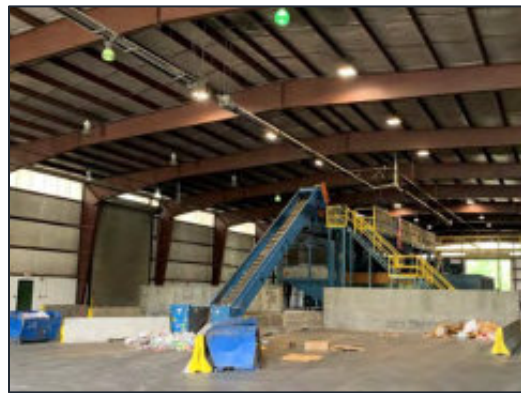
Source: RCSWA

Materials are tipped inside the facility and pushed onto an infeed conveyor where they are carried across an elevated sort line. Here workers perform a “positive sort,” manually removing recyclables and pushing them into storage bunkers underneath the sorting line. Materials are then densified using the facility baler and stored for eventual shipment to end-users. The system does not feature any automated processing sub-systems or technologies such as magnets for steel cans, eddy currents for aluminum, fiber screens, or optical sorting systems for plastics. The RCSWA also includes an education room and the ability to conduct tours. Figure 2-9 below shows images from RCSWA’s facility.

Figure 2-9 RCSWA Facility and Operations



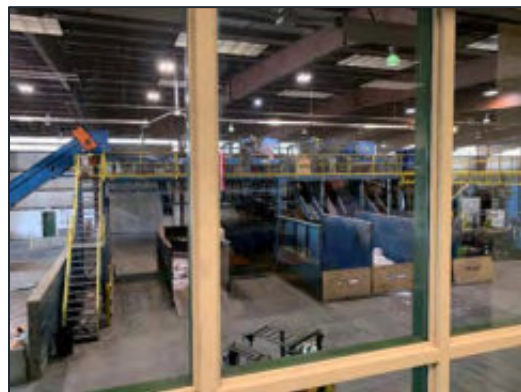
RCSWA Recycling Facility Exterior



RCSWA Tipping Floor & Infeed Conveyor



Bale Storage



Elevated Sort Line
(as seen from Education Center)

Based on our meeting and tour of the RCSWA, MSW Consultants judges it to be a well-managed and maintained facility. The RCSWA’s executive director also indicated that the facility has the ability to increase its processing capacity by three-fold (from about 2,500 tons per year to 7,500), meaning it could

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manage a potential increase in recyclables tonnages from Charleston. However, the facility is a 60-mile one-way trip from Charleston, which increases transportation and labor costs, and adds wear and tear to City vehicles.

Moreover, while the RCSWA's end-markets are exclusively domestic, revenues have been negatively impacted by the global recovered materials markets challenges brought about through China's National Sword import restrictions. The RCSWA issued a report in early 2020 which detailed these pricing and revenue challenges, and for the first time in its relationship with the City of Charleston, requested that it pay a processing fee. Indeed, upon restarting curbside recycling in September, the City agreed to pay the RCSWA a processing fee of \$175 per ton.

MSW Consultants offers the following comments on the new MOU with RCSWA for recyclables processing services:

- ◆ The \$175 per ton processing fee is one of the highest that MSW Consultants has seen, even in the post-National Sword era. The RCSWA did outline its program expenses as part of the early 2020 report to the City, but MSW Consultants further hypothesizes the following:
 - ◆ According to RCSWA's executive director, processing fees have historically not been charged to MRF customers. Operating expenses for the recycling facility have been offset through disposal tipping fees and recyclables revenues.
 - ◆ RCSWA's geographic location (as well as virtually that of every other recycling processor in West Virginia) limits its access to end-markets that may have the ability to offer higher materials revenues.
 - ◆ In recyclables processing, higher materials volumes are necessary to achieve economies of scale. At an annual throughput of approximately 2,500 tons, the RCSWA recycling facility is a small facility. According to the National Waste and Recycling Association and Governmental Advisory Associates, the "average" recyclables processing facility in 2018 processed between 200 tons per day (vs. an estimated 10 tons per day at the RCSWA facility).
- ◆ Section E of the MOU specifies that the City and RCSWA agree to reassess the per-ton processing fee for FY 2022. This gives the City both a second-year option (and the ability to make possible refinements) as well as time to assess other potential recyclables processing approaches.
- ◆ The MOU is silent on some features commonly found in larger recyclables processing contracts, including:
 - ◆ **Provisions for measuring the composition of the City's recyclables.** While RCSWA's report issued to its recycling customers in early 2020 mentioned inbound composition audits, they appeared to be presented in the aggregate, not by individual program. The City and RCSWA should at least consider performing a recyclables composition audit to establish baseline percentages.
 - ◆ **Recyclables market values are not addressed.** Again, the early 2020 report from RCSWA outlines recyclables market values; the value of the City's recyclables is unknown. This can be determined by measuring the materials composition and factoring those percentages by market prices. Baseline and regularly measuring the composition and value of the City's recyclables can provide planning-level insights, as well as be incorporated into a contract mechanism that allows for Charleston to experience some fiscal benefits (through a revenue share or processing price adjustment) when market prices improve and/or the City delivers higher-quality recyclables.
 - ◆ **Other incentives.** In addition to incentivizing a cleaner recycling stream, the MOU could also address how the City collects materials. For example, plastic bags are often cited as one of the top nuisances at recyclables processing facilities around the U.S., and considerable resources

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have been invested both in educating recyclers to not use plastic bags for packaging recyclables and equipment to manage them better in recycling facility environments. Now that plastic bags are optional, and the City is promoting the use of recycling bins and personal containers, Charleston and RCSWA could consider MOU terms that incentivize the City for delivering materials loose and not in plastic bags. This could be measured and determined as part of a recyclable composition study.

2.3.3 KANAWHA COUNTY SOLID WASTE AUTHORITY (KCSWA)

Up until 2014, the City of Charleston delivered curbside recyclables to the KCSWA’s facility at 600 Slack Street. The KCSWA had operated at the Slack Street location since 1994, purchasing it outright in 1998. The Slack Street location was a dual-stream facility and operated two manual sorting lines, including one for commingled metal, plastics, and glass containers, and one for fiber such as newspaper, mixed paper, and cardboard. Despite its dual-stream design limitations, the facility apparently accepted and processed single-stream recyclables. The KCSWA processed more than 7,700 tons of recyclables as recently as 2008, receiving materials from the City of Charleston, other municipalities in Kanawha County, and some commercial generators.

High operating costs and inefficiencies, followed by structural and safety issues within the facility, caused it to cease operation in 2012. West Virginia Recycling Services, LLC (WVRS) took over the operation of the facility under lease with the KCSWA but also struggled with operating costs and facility structural issues until finally shuttering the facility for good in 2014. The standing building was eventually demolished in 2015. In the years since the Slack Street processing facility’s demolition, the City of Charleston, as well as other jurisdictions within Kanawha County, have been party to discussions with the KCSWA and West Virginia’s Department of Environmental Protection (DEP) on the development of a new recycling center, but those discussions appear to have ended.

The KCSWA continues to operate a large public drop-off center for residents and businesses, a scale house, and materials load-out and shipment at the Slack Street location. It also operates a remote baling operation on Eden’s Ford Road. While the KCSWA operation serves a valuable purpose and produces a clean recyclables stream, the amount of recyclables received and processed has fallen dramatically during the past ten years, as shown in Table 2-10 below.

Table 2-10 Recyclables Managed by KCSWA

Year	Tons Processed
2010	7,364
2015	625
2017	585
2019	287

Source: KCSWA & WV Solid Waste Management Board (SWMB)

Figure 2-10 below shows images from the KCSWA drop-off center on Slack Street, as well as the baling operation at Eden’s Ford Road.

RECYCLING FEASIBILITY STUDY

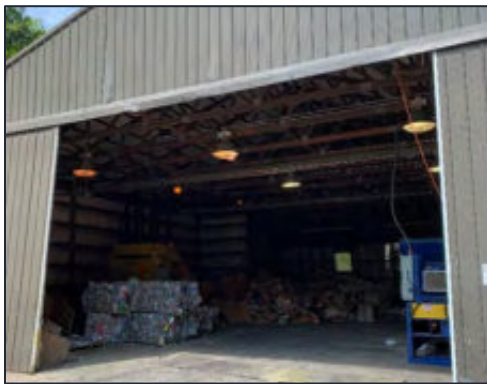
Figure 2-10 KCSWA Facilities



Public Drop-off Area at KCSWA (Slack Street)



Outdoor Bale Storage (Slack Street)



Eden's Ford Facility Entrance



Eden's Ford Baling Operation

2.4 SUMMARY OF PROCESSING OPTIONS AND EXPECTED PROCESSING COST

Table 2-11 below offers a comparison of the recyclables processing facilities utilized by Charleston either currently or in the past.

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Table 2-11 Comparison of Recyclables Processors

Facility Attribute	Kanawha County	Raleigh County
Owner:	KCSWA	RCSWA
Operator:	KCSWA	RCSWA
Location:	Charleston	Beckley
Distance from Charleston (1-way):	~1 mile	~60 miles
Processing System:	Curb-sort	Single stream
Materials Accepted:	Newspaper	Newspaper
	Mixed paper	Mixed paper
	Carboard	Carboard
	Aluminum cans	Aluminum cans
	Steel cans	Steel cans
	PET plastics	PET plastics
	HDPE plastics	HDPE plastics
Annual Tonnage:	< 300 (2019)	~ 2,400
Available Capacity?	Unknown	Yes
Processing Fee (\$/ton):	N/A	\$175

To provide further context on recyclables processing pricing, MSW Consultants reviewed data from other regions of the U.S. Although specific terms and pricing are not available or presented, Table 2-12 below shows reported processing fees from 2019 and 2020 based on a large-scale survey of communities with processing contracts, as well as research performed by MSW Consultants on behalf of a large, Southwestern U.S. city. As shown, processing of recyclables is reported to range from \$70 to over \$90 per ton at the current time, and MSW Consultants is aware of a number of instances where recyclables processing exceeds \$100 per ton.

Table 2-12 Recyclables Processing Pricing in U.S. Regions

Region	Source	Year	Average Fee	No. Communities or MRFs Reporting
Northeast & Mid-Atlantic	Northeast Recycling Council (NERC)	2020	\$91.00	18
Southeast	The Recycling Partnership	2019	\$70.75	31
Southwest	MSW Consultants	2019-2020	\$77.76	7

2.4.1 ALTERNATIVE: TRANSFER OF RECYCLABLES

Given the deficiencies in the current processing alternatives, the City will need to either (a) develop a recycling transfer operation to consolidate its curbside recyclables for more efficient transportation to Raleigh County, or (b) develop local processing infrastructure.

A recycling transfer operation would consist of a covered pad where curbside recyclables could be tipped from collection vehicles and then loaded into a larger container for more efficient transportation to a remote facility. Figure 2-11 shows both a floor loading transfer operation and a top-loading transfer operation. Floor loading operations are less expensive for smaller amounts of material because they require only a bucket loader and some reinforced push walls to load recyclables. Top load transfer facilities require

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a properly designed building with an upper and lower grade, where the upper level is the tip floor, and the lower level allows trailers to pull through for loading.

Figure 2-11 Transfer Options



Floor Loading



Top Loading

Regardless of the type of transfer operation, it should be noted that the quality of the recyclables can be significantly degraded during the transfer process. Each time recyclables are handled by heavy equipment, paper can be further shredded, and any contamination contained in the load of recyclables (i.e., bags of trash, food wastes still contained in recyclable packaging, etc.) can be further spread around. Further, should the City ever add glass to its recycling program (due to a new market or some unforeseen improvement in glass recycling economics), a transfer operation will increase breakage of glass and cross-contamination of glass particles into the paper and cardboard fraction.

Figure 2-12 shows a typical tractor/trailer used for long-hauling of wastes or recyclables. These trailers typically employ a walking floor to offload materials at the processing facility.

Figure 2-12 Long-haul Transportation via Tractor Trailer



The establishment of a recyclables transfer and hauling operation would enable more cost-effective use of the Raleigh County recycling facility by eliminating the use of compactor trucks for long-haul of materials.

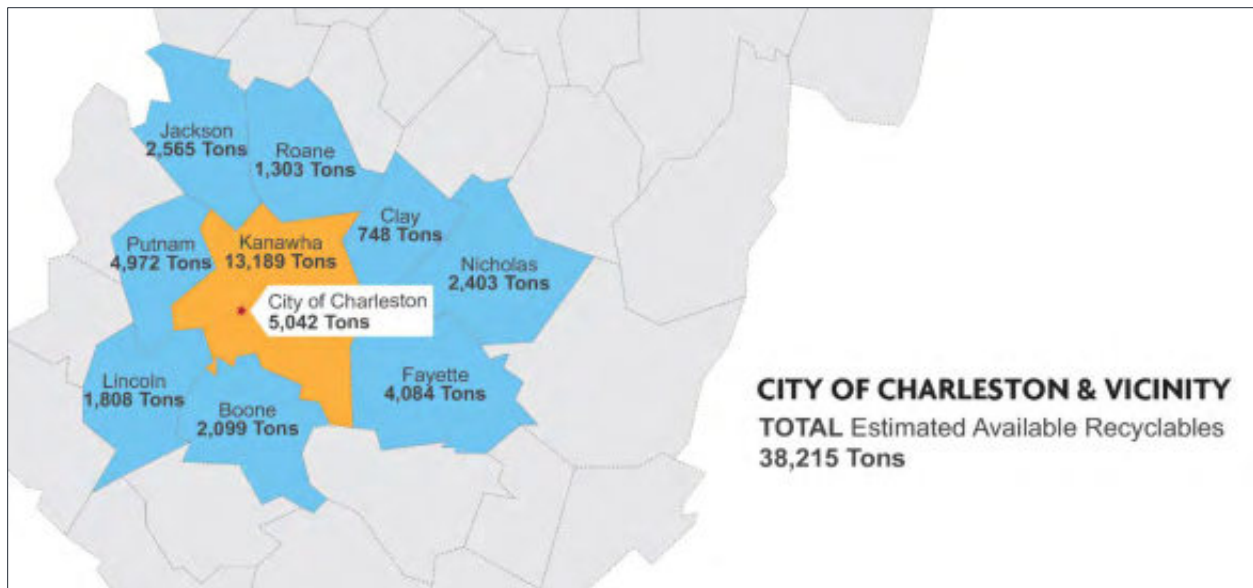
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2.4.2 ALTERNATIVE: DEVELOP A LOCAL RECYCLABLES PROCESSING FACILITY

The development of a local recyclables processing facility is, in the opinion of MSW Consultants, likely to be the best solution to establish effective City and regional recycling. Simply stated, a locally-sited facility would capitalize on the most important attribute of Charleston regarding recycling: namely, that the most geographically concentrated generation of recyclable materials exists in Kanawha County. Recyclables processing facilities are more economical at a larger scale, and it makes the most sense to build a larger facility closer to where the recyclables are being generated.

Based on MSW Consultants' review of the capital region's population and potential recyclables yields, we can estimate that nearly 40,000 tons of residentially-generated recyclables could be captured and processed from the counties adjacent to Kanawha through a regional recyclables processing facility. This planning-level estimate, which is based on applying a moderate to high estimate of the pounds of recyclables (including glass) captured from every residential household, is shown in Figure 2-13 below. (Note that, as a practical matter, every incorporated city and every county in the region would need to make substantial changes to their residential recycling programs to actually capture this material; however, the exercise is illuminating to estimate the region's long range recycling potential.)

Figure 2-13 Potential Regional Recyclables Yields



A publicly owned facility could be funded by lower-cost debt, operated without regard to the same financial performance metrics typically applied by investor-owned waste management companies, yet could still leverage private sector know-how with an operating contract (public-private partnership). As noted earlier in this section, investment and operating costs for recyclables processing facilities decrease with higher materials volumes.

2.4.3 ALTERNATIVE: MINI MRF'S

Although the recyclables processing industry has seen single-stream facilities increase in size and throughput, recent entrants have come into the market seeking to bring single-stream processing to smaller communities, often in more rural areas where large-scale facilities cannot be justified. These so-called Mini Materials Recovery Facilities (Mini MRFs) target smaller communities that typically generate 10,000 tons of recyclables per year or less. One such type of facility has been developed by Revolution Systems out of Colorado and is currently operating in the Town of Steamboat Springs, Colorado. Revolution Systems is

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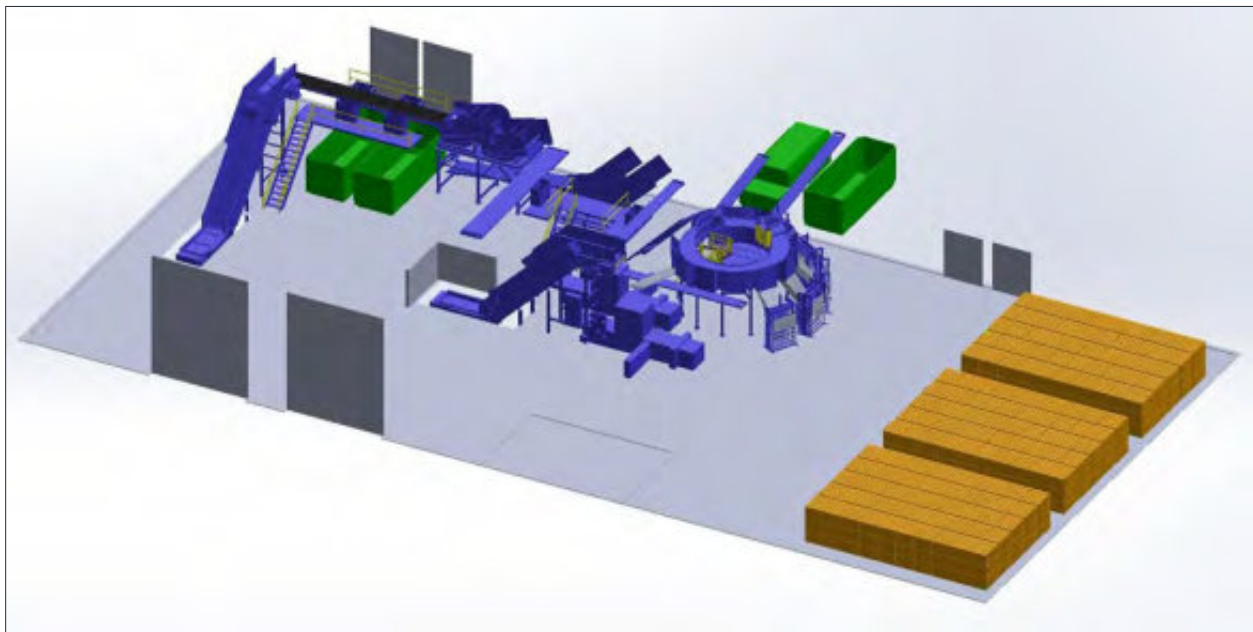
also developing a similar facility in Cumberland County, New Jersey, which is slated to come on-line in mid-2021. The company is slated to begin development of four additional plants later during 2021.³

The Mini MRF concept is being driven in part by Closed Loop Partners (CLP), which is an arm of a private investment fund that seeks to expand materials recovery and circular economy supply chains across the U.S. CLP's investment portfolio includes materials processors and end-users, as well as state and local governments. In discussions with MSW Consultants about Mini MRFs and the Revolution System, CLP shared the following details:

- ◆ The Revolution System is modular and is custom-designed for the program. They can be managed “turn-key” by Revolution or be designed for operation by the host jurisdiction. Revolution Systems manages the plant design, set-up, and initial staff training.
- ◆ Systems typically require about 15,000 square feet of space, which allows for the processing system's footprint, tipping floor space, and bale storage. The processing systems feature magnets, balers, and metered feed systems but do not include fiber screens or optical sorting devices.
- ◆ A program's recyclables materials mix can have a significant impact on the plant's operation (i.e., contaminants and glass make it more expensive to operate).
- ◆ According to staff from CLP, the system operates best at a recyclables processing rate of five tons per hour.
- ◆ CLP is capable of marketing the recyclables processed through the Revolution System.
- ◆ The system generally requires a capital investment of approximately \$1 million. This assumes a per-ton capital cost of \$25 (a five-year payback) and an operating cost per-ton of approximately \$70.

Figure 2-14 below shows a conceptual plan and footprint of such a processing system obtained from the company's literature.

Figure 2-14 Mini MRF



³ MSW Consultants does not endorse any provider of recyclables processing equipment or services. This vendor is identified, however, because they are specifically targeting smaller markets such as the City of Charleston, where large-scale MRFs may not be economically viable.

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On an even smaller scale, the same vendor also provides a mobile Mini MRF system that be transported to different material storage locations. This system is primarily designed for large-scale events but can also be used for smaller communities and support existing MRFs. An image of the Mobile Mini MRF system from CLP's literature is shown below as Figure 2-15.

Figure 2-15 Mobile Mini MRF



Mini MRFs tend to be more reliant on manual sorting and of course have not been widely established yet. The next several years will better inform whether Mini MRF technologies can establish a successful track record.

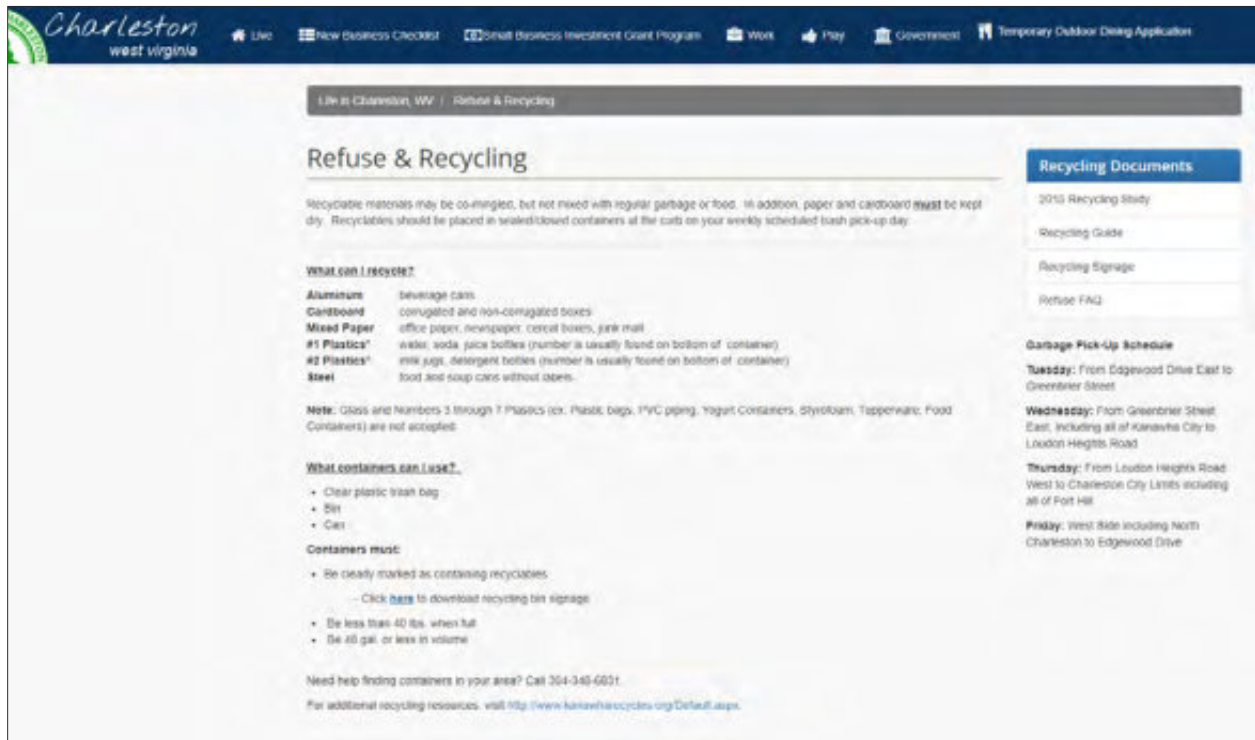
It is also important to note that establishment of any new recyclables processing capacity in and around Charleston should apply best practices for the competitive procurement of the processing system or facility.

2.5 RECYCLABLES OUTREACH AND EDUCATION

MSW Consultants reviewed Charleston's recycling outreach and education materials and elements and offers the following observations.

- ◆ **City Website:** The City's website landing page offers a direct link to recycling program information. A screenshot of the landing page is shown below as Figure 2-16, while it can be accessed here: <https://www.charlestonwv.gov/charleston-life/recycling>.

Figure 2-16 Recycling Landing Page on Charleston Website



- ◆ **Outreach Materials:** MSW Consultants was provided with or able to locate the following recycling program outreach materials:
 - ◆ **Recycling Guide:** This is a one-page MS Word document that is downloadable from the City’s website here: <https://www.charlestonwv.gov/node/1457>
 - ◆ **Recycling Frequently Asked Questions (updated):** Charleston published an updated recycling FAQ after the City Council voted to relax the requirements for using clear plastic bags. This is the only outreach document with images and can be located and downloaded here: <https://www.charlestonwv.gov/index.php/documents/refuse-faq-wed-12212016-1547>
 - ◆ **Recycling Bin Decal:** Because Charleston residents are able to use their personal recycling bins, the City makes a downloadable bin decal available. It can be found on the City’s website here: <https://www.charlestonwv.gov/sites/default/files/non-departmental-documents/2019-11/recycling.pdf>. The decal is also displayed below as Figure 2-17.

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Figure 2-17 Charleston Recycling Bin Decal



- ♦ **Recycling and Refuse Frequently Asked Questions:** The FAQ document details acceptable recyclables and unacceptable materials and publishes Refuse and Recycling's phone numbers. The FAQ also provides additional insights on plastics recycling. The document can be located and downloaded here: <https://www.charlestonwv.gov/sites/default/files/non-departmental-documents/2019-05/Refuse%20FAQ.pdf>
- ♦ **Kanawha Solid Waste Authority Website:** The City also lists the KCSWA's website as an educational resource. Although it is unknown how active the KCSWA's website is, it *appears* to provide up-to-date information on what is acceptable for recycling in Charleston, as well as other jurisdictions in Kanawha County. The KCSWA website also provides more general information on the benefits of recycling. The link to the KCSWA's website can be found here: <https://www.kanawharecycles.org/Default.aspx>. A screenshot of the KCSWA website's landing page is shown below as Figure 2-18.

Figure 2-18 KCSWA Website Landing Page



- ◆ **City Council Support:** Elected officials in Charleston, including Mayor Amy Goodwin and members of the Charleston City Council, have shown strong support for improving the City’s recycling programs. The City Council has a standing Environmental and Recycling Committee, which has reviewed and approved changes to the recycling program during the past two years. These include approval of the mayor’s proposal to eliminate the provision of clear recycling bags, as well as the renewed agreement with RCSWA for recyclables processing services.

MSW Consultants presented an overview of the Recycling Feasibility Study to the Environmental and Recycling Committee and took questions during its meeting of October 7, 2020 MSW Consultants’ presentation from this meeting is included in the report appendix. MSW Consultants also provided an update at the Committee’s December 9th meeting.

- ◆ **Green Team:** The Council also voted in August 2020 to establish a seven-member citizen “Green Team” to engage in community outreach and advise the Council on recycling as well as broader sustainability issues. The Green Team is slated to meet on a quarterly basis and issue an annual report. Members are to be recommended by the Environment and Recycling Committee and appointed by the mayor for two- and three-year terms. The City’s public works director is designated as a non-voting ex-officio member.

Observations – It is MSW Consultants’ professional opinion that the City’s recycling outreach and education methods as described above are insufficient. Recommended improvements to the City’s recycling education and outreach program will be presented in Section 5 of this report.

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3. PROGRAM COMPARISONS & BENCHMARKING

Combined with performance measurement, benchmarking enables a local government to see how its solid waste management system measures up to other municipalities with comparable customer bases and service levels. It should be noted that while benchmarking is conceptually simple, in the realm of solid waste management, there are myriad system characteristics that are likely to differ among different municipalities. For example, even if the customer base of two municipalities is the same, differences in underlying system characteristics may diminish the comparability of the two systems.

MSW Consultants compiled information from similarly-sized regional cities to allow for basic comparisons of program service levels and performance. MSW Consultants used performance statistics from 2019 and published operating budget data from either FY 2020 or FY 2021. The information used was researched primarily through publicly available documents and reports from the profiled cities such as webpages, solid waste and recycling plans, operating budgets, and reported performance measures.

Table 3-1 below shows the cities reviewed as part of the benchmarking research.

Table 3-1 Charleston Benchmarking Cities

City	State	Population ⁽¹⁾
Charleston ★	WV	46,536
Annapolis ★	MD	39,223
Harrisburg ★	PA	49,271
Morgantown	WV	30,549
Huntington	WV	45,110
Parkersburg	WV	29,306

★ = State capital

⁽¹⁾ 2019 U.S. Census estimate

3.1 BENCHMARKING: SYSTEMS & FINANCIALS

Table 3-2 below presents the key system and financial metrics from among the benchmarked cities.

Table 3-2 Benchmark City Systems & Financials

City	Service Provider	Solid Waste Budget	Employees	Recycling Coordinator?
Charleston	City	\$3.29 M	66	Yes ⁽¹⁾
Annapolis	Contractor	\$3.28 M	4	Yes ⁽²⁾
Harrisburg	City	\$16.1 M ⁽³⁾	68	Yes
Huntington	City	\$3.63 M	37	No
Morgantown	Contractor	\$1.53 M	Not available	Not available
Parkersburg	City	\$2.58 M	24	No

⁽¹⁾ P/T grant-funded position

⁽²⁾ Position also supports overall City sustainability program

⁽³⁾ Budget includes commercial services

Observations – MSW Consultants’ observations of the data presented in Table 3-2 include:

- ◆ All cities, with the exception of Annapolis, MD, and Morgantown, use municipal crews and trucks for solid waste collection services (Annapolis moved to contracted collections 2012).

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- ◆ Two of the profiled cities have professional staff who oversee their city’s recycling programs.

3.2 BENCHMARKING: COLLECTION SERVICES

Table 3-3 below details curbside collection service among the profiled cities.

Table 3-3 Benchmark City Collection Services and Monthly Rates

Service	Charleston	Annapolis	Harrisburg	Huntington	Morgantown	Parkersburg
REFUSE						
Frequency	Weekly	Weekly	Weekly	Weekly	Weekly	Weekly
Container Type	Personal containers & bags	Personal containers	City-provided containers	Personal containers & bags	Personal containers & bags	Personal containers & bags
Collection Style	Manual	Manual	Manual	Manual	Manual	Manual
RECYCLING						
Frequency	Weekly	Weekly	Weekly	N/A	Weekly	Weekly
Container Type	Personal containers or bags	Carts or bins (city-provided)	Bins (city-provided)	N/A	Carts (hauler-provided)	Bins (city-provided)
Single Stream or Dual Stream?	Single stream	Single stream	Single stream	Single stream	Single stream	Dual-stream
Collection Style	Manual	Manual	Semi-Automated	N/A	Automated	Manual
YARD WASTE						
Frequency	N/A	Weekly	Seasonal (leaves only)	N/A	N/A	N/A
Collection Style	N/A	Manual/Semi-Automated	Vacuum truck	N/A	N/A	N/A
MONTHLY RATE	\$18.00	\$22.83	\$32.34	\$20.00	\$19.80	\$16.00

Observations – MSW Consultants offers the following comments on the benchmark cities’ collection services:

- ◆ With the exception of Huntington, all profiled cities provide weekly recyclables collection. Apart from Parkersburg, all cities collect materials single stream.
- ◆ Huntington does not provide curbside recycling services. Residents who wish to recycle in Huntington must use the recycling drop-off program managed by the Cabell County Solid Waste Authority (CCSWA). The program includes a centralized drop-off center and a mobile site open on the first and third Saturdays of each month. CCSWA charges residents \$75 per year for this service, and drop-off site access is achieved through the use of a CCSWA-issued FOB device.
- ◆ All of the benchmark cities that provide curbside recycling services issue residents standardized recycling bins or carts. Harrisburg and Morgantown provide either semi or fully-automated collections.
- ◆ The cities of Annapolis and Harrisburg are the only benchmark cities that appear to provide some level of source-separated yard waste collections for composting.

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3.3 BENCHMARKING: RECYCLABLES COLLECTED

As detailed in Table 3-4 below, all benchmark cities provide collections of a standard suite of “blue bin” recyclables.

Table 3-4 Benchmark City Recyclables

Category	Item	Charleston	Annapolis	Harrisburg	Huntington	Morgantown	Parkersburg
Paper	Corrugated cardboard/kraft paper	Yes	Yes	Yes	Yes	Yes	Yes
	Mixed Paper	Yes	Yes	Yes	Yes	Yes	Yes
	Newspaper	Yes	Yes	Yes	Yes	Yes	Yes
	Other	N/A	N/A	Cartons	Cartons	N/A	Shredded paper
Plastics	#1 PET bottles and containers	Yes	Yes	Yes	Yes	Yes	Yes
	#2 HDPE natural bottles	Yes	Yes	Yes	Yes	Yes	Yes
	#2 HDPE colored bottles	Yes	Yes	Yes	Yes	Yes	Yes
	Rigid plastic containers #3-#7	No	Yes	Yes	Yes	Yes	No
	Rigid plastics (i.e., toys, milk crates, etc.)	No	Yes	No	No	Yes	No
	Other plastics	N/A	N/A	N/A	N/A	N/A	Plastic bags
Glass	Glass bottles and jars	No	Yes	Drop-off only	Yes	Yes	Yes
Metals	Aluminum cans	Yes	Yes	Yes	Yes	Yes	Yes
	Steel cans	Yes	Yes	Yes	Yes	Yes	Yes

Observations – MSW Consultants’ observations include:

- ◆ Harrisburg is the only other city that does not accept glass in its curbside recycling program (they instead accept it source-separated at a drop-off center). Note that glass typically makes up between 15 and 25 percent of a recycling program’s tonnages.
- ◆ By not accepting aseptic cartons, #3-7 plastics, rigid plastics, and glass, Charleston appears to have the most restrictive list of acceptable recyclables. However, little is known about the actual ability of the cities that do accept these materials to successfully market them (markets for all have been limited).

3.4 BENCHMARKING: COMPARATIVE PERFORMANCE

Table 3-5 below compares solid waste tonnage generation among profiled cities:

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Table 3-5 Benchmark City Tonnage Comparison

City	Households Served	Refuse	Recycling	Yard Waste	Other	Total MSW Generation	Generation Per HH (Lbs./Year)
<i>Charleston</i>	18,000	24,129 ⁽¹⁾	631	1,841 ⁽²⁾	162 ⁽³⁾	26,763	2,974
Annapolis	8,800	7,986	3,013	1,753		12,752	2,898
Harrisburg ⁽⁴⁾	20,520						-
Morgantown	10,522	⁽⁵⁾	967			967	-
Huntington	17,755	18,000	⁽⁶⁾		2,400 ⁽⁷⁾	20,400	2,298
Parkersburg	13,152	14,753	1,077			15,830	2,407

⁽¹⁾ Includes bulky wastes

⁽²⁾ Materials currently collected with refuse

⁽³⁾ Includes recycled scrap metals and white goods (125 tons) and tires (37 tons)

⁽⁴⁾ Data not made available

⁽⁵⁾ Data not made available

⁽⁶⁾ Huntington residents are eligible to use the Cabell County Solid Waste Authority's (CCSWA) recycling drop-off center. CCSWA reported 623 tons of recyclables in 2019, although it is unknown how many originated from Huntington residents.

⁽⁷⁾ Includes bulky wastes

Observations – MSW Consultants’ review of disposal and recycling tonnages reported by the profiled cities includes:

- ◆ At 2,974 pounds of municipal solid waste, or MSW (includes refuse, recyclables, yard waste, bulk, etc.) collected, Charleston has the highest annual per-household generation rate among the profiled cities. This may be due to a lenient set-out policy for bulk wastes that currently exists in Charleston, and also on the relatively higher household median income in Charleston relative to the other West Virginia cities profiled. Higher incomes typically result in higher consumer spending, which can lead to higher levels of MSW generation.

4. RECYCLING SYSTEM OPTIMIZATION

The subsections below offer viable options for the City of Charleston’s recycling program and also contain specific recommendations for what this program might look like.

4.1 COLLECTION

Given the current system, the following actions can potentially improve the City’s recycling program performance. These include:

4.1.1 DISTRIBUTING STANDARDIZED RECYCLING CONTAINERS

Whether recycling bins or carts can be collected using manual, semi- or fully-automated trucks, the City would be well served to distribute standardized recycling containers to its households. This would have the effect of providing recyclables storage capacity for participants, as well as aid collections through clearer identification of recycling set outs. Images of curbside recycling bins and carts are shown below as Figure 4-1.

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Figure 4-1 Recycling Container Options



Recycling Bins



Recycling Cart

4.1.2 AVOID BAGGED RECYCLABLES

As noted in Section 2, plastic bags are often cited as one of the top nuisances at recyclables processing facilities around the U.S., and considerable resources have been invested both in educating recyclers to not use plastic bags for packaging recyclables and in equipment to manage them better in recycling facility environments. Recyclables processing centers require significant shut-down time for staff to remove plastic bags that wrap around a modern facility's many moving parts. Figure 4-2 below shows plastic bags wrapped around a star screen at a large recyclables processing facility.

Figure 4-2 Plastic Bags at the Curb & at the Recycling Center



Plastic Bags at a Recyclables Processing Facility

Photo Source: The Recycling Partnership

4.1.3 MOVING BEYOND MANUAL COLLECTIONS

While single-stream collection systems can take many forms, the most common systems capitalize on one or two crew members operating high-capacity semi- or fully-automated technologies to maximize collection productivity. Both semi- and fully-automated trucks feature higher productivity rates and lower

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injury rates compared to manual collection systems. A summary of semi- and fully-automated collections follows:

- ◆ **Semi-Automated** is a method of collection that utilizes mechanical cart tippers on the rear of the truck to lift and empty containers. This technology still requires an equipment operator and at least one helper on the collection crew, such that the helper still needs to retrieve and roll the carts to the truck for emptying. Semi-automated systems also require that a standardized cart be issued to every resident.
- ◆ **Fully-Automated** trucks most often use a hydraulic arm located on the right side of the vehicle that lifts the carts overhead and empties materials into the hopper. Fully-automated routes are meant to be performed with only a single operator, reducing labor costs even further.

These types of recycling systems use roll-out carts, most often in the 64 to 95-gallon capacity, which offers recyclers significantly more space to store materials compared to standard recycling bins. Images of semi-automated and fully automated collections are shown in Figure 4-3 below.

Figure 4-3 Cart-Based Collection Options



Semi-automated Collection



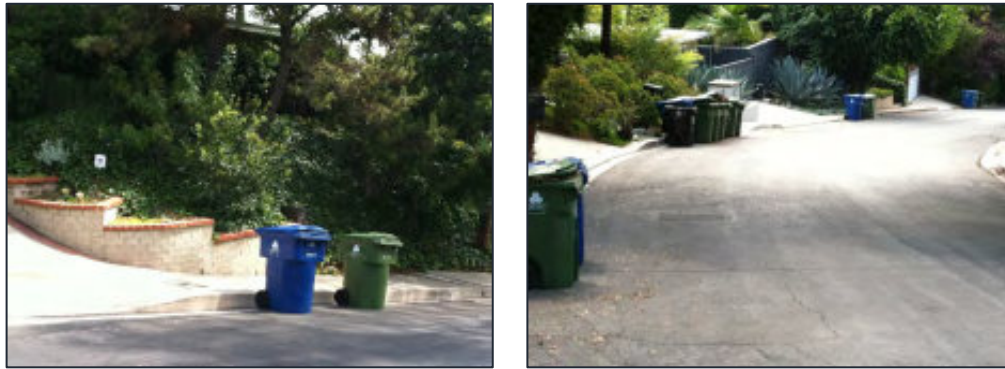
Fully Automated Collection

However, there are challenges with cart-based systems, which can include:

- ◆ **Equipment Costs:** Semi- and fully-automated trucks are significantly more expensive to purchase and maintain compared to standard rear loaders.
- ◆ **Cart Costs:** Carts generally cost between \$55 and \$65 per unit, depending on size and features. There are also administrative and maintenance costs for carts systems. Customers may need to be allowed to change cart sizes over time. The City will also need to make arrangements to manage, repair, and distribute carts and should have the ability to perform this task, although doing so may require increased storage capacity on DPW property for replacement carts and associated parts. Cart inventory management, using Radio Frequency Identification (RFID) tags, is offered by multiple vendors serving the waste collection market.
- ◆ **Routing and Logistics:** Cart-based collections may also require jurisdictions to require other-side-of-street parking to ensure adequate access.
- ◆ **Recyclables Contamination:** Recyclables contamination rates can increase for a variety of reasons, first and foremost because the recyclables are now completely hidden in the cart, and it is not possible for the equipment operator to identify the contamination prior to tipping.
- ◆ **Charleston Topography:** City staff have also expressed other concerns about the feasibility of bringing cart-based collections due to Charleston's topography and steep hills. However, MSW Consultants is familiar with cart-based collections in other jurisdictions also known for steep hills. Figure 4-4 below shows an example from the Hollywood Hills in Los Angeles, California.

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Figure 4-4 Cart-Based Collections on Hilly Terrain



MSW Consultants does recognize that portions of Charleston may not be conducive to cart-based collections. But, on balance, improvements could be made to Charleston’s existing system by standardizing the collection containers for trash and adding semi-automated capability to the collection fleet and future truck replacements. Rolling out a cart to service with a hydraulic tipper as opposed to manually collecting multiple bags or multiple and varied containers and returning them to the curb should reduce physical hazards to collection crews.

4.2 EXPENDITURES AND REVENUE SUFFICIENCY

For Task 1.5 of the project scope, MSW Consultants performed a cost-of-service estimate for the City’s recycling program. This includes high-level assessments of the City’s revenue sufficiency as well as annual expenses.

The City’s rates by customer class and projected annual revenues are detailed below as Table 4-1.

Table 4-1 System Revenues vs. Expenditures

Customer Class	No. of Ratepayers	Monthly Rate ⁽¹⁾	Annual Rate	Total Revenue
Residential	18,000	\$18.00	\$216.00	\$3,888,000
Dumpster	67	\$40.00	\$480.00	\$32,160
				\$3,920,160

Source: ⁽¹⁾ City of Charleston Code

Table 4-2 below shows the City’s refuse and recycling annual expenditures.

Table 4-2 Annual Expenditures

Expenses	FY 2019 Actual	FY 2020 Budget	FY 2021 Adopted
Personal Services ⁽¹⁾	\$3,127,591	\$3,387,138	\$3,123,515
Contractual Services ⁽¹⁾	\$232,177	\$75,891	\$76,382
Commodities ⁽¹⁾	\$476,310	\$94,200	\$94,200
Lease Payments ⁽²⁾	N/A	N/A	\$515,510
Total	\$3,836,078	\$3,557,229	\$3,809,607

Sources: ⁽¹⁾ Municipal Budget, 001 (General Fund), 800 (Refuse & Recycling)

⁽²⁾ Projected Capital Equipment Acquisitions, Health & Sanitation

Based on this high-level assessment of data provided by the City, it appears that the City has been able to meet its system financial requirements during the past three fiscal years.

5. RECOMMENDATIONS

There are numerous details to every municipal waste management system, and no two cities or counties will be the same. Practices that are considered “Best Management Practices” (BMPs) in one city may not be effective or appropriate in another city. Further, there are multiple policies, operational practices, educational strategies, and program goals that can be employed to optimize a system.

MSW Consultants has extensive experience analyzing and optimizing the components of successful municipal waste management systems, with particular emphasis on recycling program effectiveness. In this section, we offer our professional opinion on how the City of Charleston can transform its solid waste management system to provide a financially sustainable, high-diversion curbside recycling program.

5.1 PREREQUISITES

The scope of this Study focused on the City’s recycling program and collection services. However, extensive experience across the United States show that municipal waste management programs operate as an integrated system that requires a stable and sustainable revenue source and provide a suite of services that include recyclables collection and processing, trash collection and disposal, bulk waste collection and disposal, and in many cases yard waste collection and processing.

Although it was beyond the scope of this Study to evaluate the City’s broader integrated waste management system, MSW Consultants believes there are several critical prerequisites to be accomplished before optimizing the City’s recycling system. These are itemized below:

- ◆ **Sustainable, Equitable Waste Management Revenue Mechanism:** Municipal waste management systems closely follow the utility business model. These systems provide standard, well-defined services to all of the customers in the service area. As with any utility, it is therefore critical to have a fair, transparent, and revenue-sufficient mechanism in place to recover the cost of the services from the customers who receive the services. Although the City has a monthly user fee, it is not known whether this revenue mechanism is fully funding the solid waste management system. However, the observations made during this Study confirm that the current flat-rate user fee, combined with a lack of set-out limits, does not fairly recover the cost of the services being provided. Additional detail about sanitation rates structures is provided below.
 - ◆ **Recommendation:** The City should undertake a full cost-of-service and rate study for its entire waste management system. This Study should identify the full cost to provide the current services and identify appropriate rate structures that (a) cover basic services to all customers at a fair price and (b) offer premium services at an incremental charge to those customers needing more than the basic service levels.
- ◆ **Waste Management Organizational Structure:** As with any utility service, waste management requires experienced, well-rounded management and expertise to handle the many facets of the operation. The City’s organizational structure is reasonable, with a Sanitation Deputy Director, Recycling Coordinator, and Operations Supervisor leading the division. However, the job descriptions for these positions should be revisited to empower these individuals to manage future program direction, maintain sound financial performance, and evolve the services over time to be in conformance with industry best practices. Further, the waste management organization will need to integrate its services with a customer service operation and with the City finance department to establish and collect user fees and premium charges in an optimized system.
 - ◆ **Recommendation:** The City should update the job descriptions, roles, and responsibilities of these senior management positions and simultaneously offer management and operational

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training to existing staff in these roles. The Solid Waste Association of North America (SWANA) offers a wide range of professional certifications that enable industry professionals to gain specialized knowledge and expertise. The City should also enable senior sanitation and recycling managers to attend conferences and trade shows, which (even virtually) offer a wealth of information on current trends, successful case studies, and best practices.

- ◆ **Optimized Refuse and Bulk Waste Collection Services:** As observed during this engagement, on the surface, the City of Charleston provides excellent customer service to its residents, in the sense that City collection crews will remove virtually any materials from the curb that are set out by residents. Based on our observations and confirmation from PWD leadership, collection crews routinely load piles of bagged materials, multiple containers, multiple bulky items, and even loose brush and yard waste materials. However, the lack of reasonable set-out limits undermines the City's ability to provide a fair, standard basic service. Studies in other communities with no set-out limits have shown that 20 to 30 percent of the residential customers over-use the service, which means that the remaining 70 to 80 percent of customers are subsidizing the system.
 - ◆ **Recommendation:** The City should evaluate and optimize its residential refuse and bulk waste collection services with an eye towards (a) rebalancing the collection routes, (b) standardizing set-out limits for basic service, and (c) establishment of additional fees for residents that require additional service (as described in the prior bullet). This change to the system will likely need to integrate an enforcement component and changes to the City's ordinance to enable the City to charge residents who exceed reasonable set-out allowances.
- ◆ **Transition to Cart-based Collection:** Historically, sanitation services have been provided via manual collection. Certainly, Charleston has some narrow and hilly streets where manual collection appears to be the best method (or only method) for collecting materials. However, manual collection systems are increasingly a liability on several levels. Manual collection systems have higher rates of injury and workers compensation claims. Manual collectors are at higher risk of serious accidents, including being struck by other vehicles. Cart-based collection reduces the physical wear-and-tear on manual collectors, but more importantly, can set up a longer-term transition to full automation in some parts of the City. Fully automated collection is much more efficient than manual collection, so even if only parts of the City could migrate to automated collection, it should benefit the system.
 - ◆ **Recommendation:** The City should move towards greater automation for all of its collection services. Converting from manual to semi-automated collection would enable most residential customers to convert to carts while leaving the ability to collect manually from selected streets and neighborhoods. Over time, as semi-automated collection is optimized, the City will be able to identify areas that can convert to full automation. Refuse collection vehicles offer hybrid technologies to support a combination of manual, semi-automated, and fully automated service on a single route. Additional information about automated collection is provided below.
- ◆ **Develop a Comprehensive Recycling Education and Outreach Strategy:** Public outreach and education have become even more critical for recycling programs during the past two to three years, given recycling end-market demand for cleaner recyclables. Recycling education and outreach spending should not be considered a one-time expense. While public education spending benchmarks are not widely available, MSW Consultants believes routine education and outreach spending for robust recycling and waste management programs should average roughly \$1.50 to \$2.00 per household annually and may double during major system changes.

Outreach and education are critical tools and are necessary for ensuring quality recyclables, but also for maintaining and expanding participation. Charleston should develop a recycling outreach and education strategy to improve program participation. Recommendations include:

- ◆ **Overall Messaging:** The City’s recycling education and outreach should more clearly promote what is recyclable in the recycling program, how to prepare those items, and what the key materials are that should be left out of recycling bins (i.e., contaminants). Moreover, the messaging should also communicate the value and benefits of recycling to program participants, including environmental benefits and economic benefits.
- ◆ **Program Literature:** The City’s existing program literature is not eye-catching and lacks color and graphics. A redesigned printed or downloadable flyer should include those features.
- ◆ **City’s Website and Social Media:** While recycling program information can be accessed from the City’s landing page (<https://www.charlestonwv.gov/charleston-life/recycling>), users have to scroll down to find the link. The City should consider rotating this to a position above the scroll. Social media posts can be particularly effective at promoting environment-themed events (such as Earth Day) or promotion of paper and packaging generated during the holiday season.
- ◆ **Mobile Apps:** During the past five to seven years, a number of recycling and solid waste services mobile apps have become commercially available. The apps can help remind residents of their pickup days, schedule changes, and what is acceptable in the recycling program.
- ◆ **Outreach in Kanawha County Schools:** As the state’s largest school district, the Kanawha County School District may offer opportunities for recycling outreach and education (at least in those Kanawha County schools within the City of Charleston). Coordination with public school systems for classroom presentations and assemblies and distribution of program literature are key elements of many recycling education and outreach programs.
- ◆ **Overall Community Outreach:** The City should examine opportunities to present to community organizations, civic associations, and business groups.
- ◆ **Engage City’s Green Team:** As noted in Section 2, earlier this year, the City Council established a seven-member citizen “Green Team” to engage in community outreach and advise the Council on recycling as well as broader sustainability issues. The Green Team should be engaged to solicit ideas and input, test and hone recycling program messaging, and circulate that messaging among constituencies.

5.2 OPTIMIZED RECYCLING IN CHARLESTON

An optimized system will have:

- ◆ Specialized, trained, and empowered management staff for sanitation and recycling
- ◆ Optimized curbside collection services
- ◆ Cart-based collections
- ◆ Access to cost-effective processing capacity
- ◆ Clear and transparent fee and incentive to recycle
- ◆ More dynamic program education and outreach

Were such a system to be established over time in Charleston, the likely cost of the system, as well as high-level performance expectations, are shown in Table 5-1. This table compares the current recycling program direct costs to a high-functioning recycling system. In such a high-functioning system, the set-out rate improves to 65 percent and the recycling yield per household increases from approximately 70 pounds per year to a still modest 200 pounds.

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Table 5-1 Optimized Recycling Cost of Service

Metric	Current	Optimized
Set-Out Rate	25%	65%
Number of Routes	3	6
Annualized Capital Cost	\$81,143	\$142,000
Vehicle O&M Cost	\$100,620	\$201,240
Labor Cost	\$583,331	\$1,166,661
Processing Cost	\$110,425	\$162,000
Total	\$875,519	\$1,671,901
Households	18,000	18,000
<i>Annual Cost per HH</i>	<i>\$48.64</i>	<i>\$92.88</i>
<i>Monthly Cost per HH.</i>	<i>\$4.05</i>	<i>\$7.74</i>
Recycling Tonnage	631	1,800

5.3 OTHER COMMENTS AND RECOMMENDATIONS

- ◆ **Impacts of Covid-19 Pandemic:** Although the actual impacts are still being evaluated, the onset of the COVID-19 pandemic, resulting in shutdowns and general behavior change, has shifted much MSW generation from the commercial to the residential sector. Many jurisdictions around the U.S. are reporting residential MSW volume increases as much as 20 percent. Industry and local government sources are also reporting changes to the composition of the waste stream, including increases in single-use plastics and Personal Protective Equipment (PPE) such as disposable masks and gloves and associated packaging. On the recycling side, programs report an increase in the amount of corrugated cardboard shipping boxes, brought on by increases in e-commerce purchases.

Nevertheless, it is unknown if the impacts observed to date will continue or if generation will slowly revert to pre-COVID levels.

- ◆ **Recycling and Economic Development:** While the end-markets and pricing challenges, as detailed in the earlier sections of this report, have had negative impacts on recycling programs in West Virginia and across the U.S., recycling still results in considerable economic benefits. Recyclables are commodities that replace or help minimize the use of raw materials and are value-added – meaning there is economic activity created at each stage of a recovered material’s life cycle, from collection, to processing, to secondary processing, remanufacture, and distribution. When compared to traditional forms of solid waste disposal, recycling and reuse create many more jobs on a per-ton basis.

The Institute of Scrap Recycling Industries (ISRI), a trade association representing recyclables end-users and markets, and regularly conducts studies to measure the economic impact of the recycling industry in the U.S. and at the state level, calculating job creation, overall economic output, and tax receipts. ISRI’s methodology counts direct job creation that occurs from processing, purchasing, and brokering of recovered materials as well as supplier and induced jobs that are indirectly supported through suppliers and the industry’s overall economic impact.

Table 5-2 below presents economic impacts in West Virginia from a study issued by ISRI in 2019.

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Table 5-2 Economic Impact of Recycling in West Virginia

	Direct	Supplier	Induced	Total
Jobs	713	767	711	2,191
Wages (in \$ millions)	\$34	\$44	\$30	\$113
Economic Impact (in \$ millions)	\$164	\$195	\$116	\$474

Source: Institute of Scrap Recycling Industries (2019)

- ◆ **Pay-As-You-Throw:** Pay-As-You-Throw (or PAYT) is a possible approach to system financing that the City could consider. In communities with Pay-As-You-Throw programs (also known as unit pricing or variable-rate pricing), residents are charged for the collection of refuse based on the amount they throw away.⁴ This user-fee approach is similar to how public utilities such as water and electricity charge for services, creates a direct economic incentive to recycle more and to generate less waste, and eliminates the inequities associated with flat fees systems where good recyclers often subsidize service costs for more wasteful residents.

Well-designed PAYT systems generate sufficient revenues to cover program services and costs. Table 5-3 below summarizes monthly rates for FY 2021 from three cities that have mature PAYT systems.

Table 5-3 PAYT Rate Examples

Refuse Container Size	Austin, TX Price Per Month	Gainesville, FL Price Per Month	Davenport, IA Price Per Month
< 30 gal.	\$21.15	\$18.50	N/A
30 - 35 gal.	\$22.40	\$24.00	\$13.41
60 - 65 gal.	\$27.55	\$29.75	\$17.09
90 - 96 gal.	\$48.00	\$37.00	\$20.80

Table 5-4 below shows a conceptual structure for a Charleston PAYT system that offers four sizes of refuse containers. When designing PAYT systems, it is important to ensure that the marginal price increase for each larger refuse container size is significant enough to customers to provide an incentive to recycle more and thereby obtain a smaller refuse container. If pricing tiers are too close to one another, more residents will opt for a larger container as the marginal savings do not provide a significant incentive. Moreover, it is important to note that it is not possible to project the exact rates for Charleston currently as they would need to be determined once new collection system attributes are defined and based on outcomes of a cost-of-service study.

Table 5-4 Conceptual PAYT Rate Structure

Refuse Container Size	Percent of HH.	Price
< 30 gal.	5%	\$14.00
30 - 35 gal.	20%	\$16.00
60 - 65 gal.	57%	\$20.00
90 - 96 gal.	18%	\$24.00

⁴ Pay-As-You-Throw Programs | Conservation Tools | US EPA.
<https://archive.epa.gov/wastes/conserve/tools/payt/web/html/index.html>

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- ◆ **Investigate Sources of Recycling Program Support:** Despite end-market challenges, there have been considerable levels of private investment in U.S. recycling infrastructure and systems during the past five to seven years. These efforts are supported by unprecedented levels of funding support from product manufacturers, brands, and trade associations. Two organizations that are currently actively involved in supporting and enhancing municipal curbside recycling programs include:
 - ◆ *The Recycling Partnership* provides recycling technical assistance, grants for carts purchases, and equipment capital for cities and counties across the U.S. Jurisdictions are eligible to apply for grant funds for carts purchases and supplemental program outreach and technical assistance. Since 2014 the Partnership had leveraged more than \$90 million in funding and helped fund and distribute recycling carts to more than 700,000 U.S. households.
 - ◆ *Closed Loop Partners* manages multiple investment funds that support recycling infrastructure, such as equipment capital for recycling facilities, secondary processors, and end-users. They also provide support for municipalities, including carts purchases. According to CLP's website, since 2014, they have helped leverage some \$270 million in investment across the U.S. and in three other nations.
- ◆ **Explore Regional Coordination:** One of the potential recyclables processing pathways forward involves the development of a local facility. A locally-sited facility could capitalize on the potential volumes of recyclables available in the region. However, buy-in and coordination among the regional partners will be critical, and many, if not all, will be required to examine their approaches to recycling to ensure that the available recyclables are delivered to the regional facility.

An initial step in fostering regional coordination should involve raising awareness among potential participants and stakeholders. Accordingly, Charleston should explore the possibilities of hosting a statewide or regional summit to discuss recycling issues. Such an event could not just have the effect of getting stakeholders and members of the recycling value chain in the same room, but it can also lead to dialogue and formulation of action strategies. Potential participants could include statewide elected officials, state agencies, solid waste authorities, state and regional recycling advocacy organizations (such as the West Virginia Recycling Association), county economic development authorities, recycling industry representatives, environmental and civic organizations, and other stakeholders.
- ◆ **Perform Customer Surveys:** Prior to undergoing significant changes to its solid waste system, the City may wish to conduct a statistically representative survey of residential households to compile defensible data and feedback regarding the service and costs. This survey could test the usage levels of the current system and seek guidance on whether residents support changes to services. Timing of the survey is critical in that it should be issued after a point where the City has framed some potential strategies for residents to react to, but before changes are put in motion.
- ◆ **Examine Return to Source-Separated Yard Waste Collection and Processing:** As noted earlier in this report, the City at one point performed some collections of source-separated yard wastes. These materials were processed by the public grounds division within the PWD. While researching and assessing resumption of these services was beyond the scope of this engagement, yard wastes, including grass, leaves, brush, and prunings can make up between 10 to 20 percent of the residential waste stream. High recovery of these materials could dramatically increase the City's recycling rate.
- ◆ **RCSWA MOU:** The City should act quickly to assess and begin discussions with the RCSWA on recyclables processing contracting (via the MOU) options for the option year set to commence on July 1, 2021. Discussions could include potential contract features framed in Section 2 of this report and should also include potential extensions for a third and fourth year, depending on longer-term recyclables processing options.
- ◆ **Pilot Testing:** To gather performance data for varying collection alternatives, the City should consider selecting subsections of Charleston to pilot its preferred semi- or fully-automated collections. Pilots

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may be able to be performed in partnership with industry equipment providers (carts, automated trucks) in ways that minimize pilot program costs. Pre-pilot and post-pilot citizen input could be obtained along with specific tracking of collection metrics. This data can be used along with the citywide residential survey results to inform City leadership regarding the best direction for the recycling system.

- ◆ **Procurement – Request for Expressions of Interest:** The City may wish to use the procurement process to test the marketplace for recyclables processing options. Many local governments have the ability to use the Letter of Interest (LOI) or Request for Expression of Interest (RFEI) process to get scoping and pricing input from vendors before committing to a formal Request for Proposals (RFP) process. This approach could be most effective as a way to better determine whether a regional recyclables processing facility is feasible and could also be useful in assessing recyclables transfer possibilities.

6. IMPLEMENTATION TIMELINE

MSW Consultants’ recommended implementation timeline is shown below as Table 6-1.

Table 6-1 Implementation Timeline

Action	Year 1	Year 2	Year 3
Perform Full Cost of Service Study			
Review Organizational Management			
Optimize Collection Services			
Transition to Cart-Based Collections			
Develop and Implement Education & Outreach Plan			
Investigate Funding Sources			
Explore Regional Collaboration			
Perform Customer Surveys			
Review Resumption of Yard Waste Service			
Revisit RCSWA MOU			
Pilot Testing (carts, set-out limits, bulk, etc.)			
Procurement (RFEI, LOI for long-term processing capacity)			