

SECTION 1 PURPOSE

This report summarizes the costs of the various solid waste services provided by the City of Ann Arbor (City) and its contractors. The City tracks and reports its costs for solid waste operations based on standard accounting practices employed for all departments and activities citywide. The City's FY2018 costs were reviewed to evaluate the City's costs to provide solid waste services through each of the functional operations performed. Functional operations include:

- Residential solid waste collection and disposal
- Residential compost collection and composting
- Commingled cart recycling collection
- Commercial commingled recycling collection
- Recycling processing
- Commercial solid waste collection and disposal
- City event-related, City parks, and downtown street-side container solid waste services
- Former landfill maintenance and compliance activities

Costs were compiled by function after a thorough review of the City's cost accounts and activities. In addition, indirect administrative costs were allocated to the different functions. The resulting analysis provides a detailed accounting of costs by function in total (i.e., annual cost) and on a unit cost basis (e.g., cost per household per month, cost per ton). Presenting the costs in this manner is standard within the solid waste industry and enables comparison of the City's costs for its current programs to other communities. It will also enable options included in the Solid Waste Resources Management Plan to be evaluated for cost impacts at the customer level.

The remainder of this report provides further detail on the methodology employed and the City's costs of current solid waste services, consisting of the following sections:

- Section 2 - Overview of Services
- Section 3 - Resource Management Program Area Costs
- Section 4 - Residential Cost of Service
- Section 5 - Recyclable Material Processing Cost of Service
- Section 6 - Commercial Collection Cost of Service
- Section 7 - Program Area Revenue
- Section 8 - Conclusion

SECTION 2 OVERVIEW OF SERVICES

The City provides comprehensive resource management services to the residents and businesses of the City. Services include collection and disposal of trash; collection and processing of recyclables; and collection and composting of organic materials.

The City's resource management services are provided by a combination of City crews and contracted services, as summarized in Table 1. Residential collection in Table 1 refers to single-family residences and properties of 1 or 2 units. Commercial collection includes multi-family residences of 3 or more units in addition to businesses and institutions.

TABLE 1. ANN ARBOR SOLID WASTE AND RECYCLING PROGRAM SERVICE PROVIDERS

Service	City Crews	Contracted Service
Trash		
Residential Collection	32, 64 and 96-gallon carts	
Commercial Collection	32, 64 and 96-gallon carts and property-owned dumpsters	Contracted dumpsters (Waste Management)
Disposal		Advanced Disposal Services
Recycling		
Residential Collection		32, 64 and 96-gallon carts (Recycle Ann Arbor)
Commercial Collection	64 and 96-gallon carts in the downtown and dumpsters	64 and 96-gallon carts outside the downtown and 300-gallon totes (Recycle Ann Arbor)
Processing		Recycle Ann Arbor
Compost		
Residential Collection	Yard waste bags, or 64 and 96-gallon carts	
Commercial Collection	Not currently offered	
Composting		WeCare Denali
Education and Outreach		
Programs and Services	Printed materials and website	School programs, recycling workshops (Ecology Center)

SECTION 3

RESOURCE MANAGEMENT PROGRAM AREA COSTS

The City's resource management program falls under the Public Works Unit of the City's Public Services Area. To assess the costs of service for the resource management program, actual expenses for FY2018 (July 1, 2017 to June 30, 2018) have been reviewed. The City contracts for a number of services in its solid waste operations, and FY2018 represents the first year of new contracts for waste transfer and disposal as well as for recycling processing. The new contracts are materially different in scope than the prior contracts, resulting in prior years' costs not being representative of current and going-forward costs.

The City's accounting structure tracks expenses by activity; however, some activities do not always align directly with the functional areas being considered for this analysis. For example, management and administrative operations for the program area are classified as discrete activities but support numerous functional areas. Revenues and expenses are reported as approximately 750 individual cost items categorized to more than 100 account types. Therefore, expenses have been allocated where appropriate to match the functional services (i.e., residential and commercial costs for trash, recycling, and compost collection and processing/disposal) being provided.

Based on the expenses for each functional service, the cost of service for an individual customer (resident or business) for each type of service provided is calculated. The cost of service is useful for assessing current funding methods, future funding options, and the costs of program changes or expansions. The remainder of this report identifies current expenses and calculates unit costs of service for the City's resource management program in FY2018.

FY2018 Expenses

For cost of service studies, expenses are broadly classified to the following categories:

- Operations expenses - These are direct expenses that are recognized and assigned to specific functions within the resource management area based on their activity type. Operations expenses include collection, transfer, disposal, material processing (recyclables and compost), container delivery, and other recurring activities. Operations expenses include costs of services provided by City employees as well as contracted services.
- Administration expenses - These are indirect or allocated expenses that are either shared, provide support to numerous activities, or can't be directly assigned to specific activities. Administration expenses include management, customer service, education and outreach, planning, and internal municipal services costs.
- Capital expenses - These include asset development or purchases that are in-progress. Capital expenses are typically recognized as depreciation, distributing the cost over the useful life of the asset. Capital expenses are typically direct expenses but in some cases are indirect (e.g., fleet maintenance facility) and must be allocated.

Table 2 summarizes the City's direct expenses by function in FY2018 and the total indirect expenses of the Program Area.

TABLE 2. RESOURCE MANAGEMENT PROGRAM EXPENSES FOR FY 2018

Function	Amount
Direct Expense	
Residential Waste Collection	\$1,546,972
Residential Recycling Collection ¹	\$2,829,604
Residential Compost Collection	\$1,001,257
Commercial Waste Collection	\$2,243,280
Commercial Recycling Collection	\$666,061
Waste Disposal	\$1,370,902
Recycling Processing	\$3,180,903
Composting	\$172,137
Special Events / Downtown Street-Side Container Collection	\$302,450
Closed Landfill Post-Closure Care and Maintenance	\$377,988
Indirect Expense	
Route Operations / Cart and Container Delivery	\$419,829
Management & Planning	\$646,910
Program Administrative and Municipal Services Costs Allocation	\$1,042,712
Customer Service	\$266,050
Education & Outreach	\$90,837
Total Expenses per City Budget Performance Report	\$16,157,890
Financial Adjustments ²	\$2,394,035
Total Expenses Impacting Fund Balance	\$18,551,925

Notes:

1. Residential Recycling Collection is cart-based recycling collection performed under contract by Recycle Ann Arbor, which includes a small amount of commercial recycling collection.
2. Financial adjustments include GASB pension liability, OPEB (retiree benefits), and capital assets, which were not included in the FY2018 expenses utilized going forward in this cost of service analysis because they are not directly tied to current solid waste operations. However, these adjustments do impact the Fund balance and therefore must be considered when assessing long-term Fund sustainability and are therefore reflected here as expenses impacting the Fund balance.
3. Subtotals may not sum exactly to totals due to rounding.

Cost Allocations

Indirect expenses are not tied exclusively to individual functions. Therefore, in order to assess costs of services, indirect expenses must be allocated to the various functions. The City’s operational data and service parameters were utilized to determine the allocation of indirect expenses to each function. Allocations were made utilizing data including:

- City staffing levels and collection labor hours

- Customer counts by sector (residential, multi-family, commercial)
- Collection route data including number of routes, collection frequency, collected containers, containers on-site, container volumes
- Collection truck data including fuel consumption, repair costs, depreciation, and replacement costs reported by the City's Fleet and Facilities Unit
- Collected material tons and disposed or processed tons
- Contractor invoices from Recycle Ann Arbor, Waste Management, WeCare Denali, and Advanced Disposal to obtain tonnage data and collection parameters

Utilizing these data sources, indirect expenses were allocated as follows:

- Route Operations expenses are the costs for the collection supervisors assigned to the work area. Therefore, these costs are allocated to the various collection functions proportional to the City employee labor hours expended providing services in the function. In addition, the Solid Waste Fund's Wheeler Service Center debt payment allocation is also included here.
- Program Administrative and Municipal Services Costs Allocation expenses are allocated to each function proportional to the tonnage managed through the function because the tonnage associated with each of the services provided by the City is commensurate with the level of effort expended by the City to provide the service.
- Customer Service expenses are allocated to each collection function proportional to the customer counts for each function.
- Outreach expenses are assigned entirely to residential recycling collection, as these expenses are tied directly to outreach to the City's residential recycling customers.

Table 3 on the following page identifies costs by functional service by expense type, including allocated indirect expenses as described above. Total costs from Table 3 are utilized in the subsequent sections of this report to calculate the unit costs of the services provided by the City.

TABLE 3. SUMMARY COSTS BY FUNCTION

Expense Type	Residential Waste	Cart Recycling	Compost	Commercial Waste	Commercial Recycling	Recycling Processing	City Events	Closed Landfill	Total
Direct Expense									
Labor	\$794,470	\$5,263	\$377,142	\$365,868	\$298,189	\$99,306	\$141,690	\$7,651	\$2,089,578
Operations	\$80	\$76,832	\$958	\$1,426	\$19,411	\$14,677	\$1,400	\$168,647	\$283,432
Depreciation	\$294,975	\$387,456	\$97,120	\$101,965	\$80,052	\$624,669	\$27,960	\$6,135	\$1,620,331
Vehicle Rental	\$8,153	\$355	\$415,239	\$546	\$61,240	\$2,849	\$39,969		\$528,350
Truck R&M	\$342,471	\$517,662	\$50,248	\$145,442	\$93,038	\$8,210	\$42,654	\$5,248	\$1,204,973
Fuel	\$106,474	\$98,110	\$60,550	\$37,463	\$21,191	\$593	\$3,397	\$370	\$328,149
Equipment	\$79	\$7,237		\$4,193	\$10,629	\$4,404	\$7,217		\$33,759
Utility	\$270			\$697		\$23,129		\$189,937	\$214,033
Contracted Collections		\$1,736,689 ¹		\$1,585,679	\$82,311		\$38,163		\$3,442,843
Disposal/ Processing	\$388,115		\$172,137	\$979,516		\$2,403,065	\$3,270		\$3,946,105
<i>Direct Subtotal</i>	<i>\$1,935,087</i>	<i>\$2,829,604</i>	<i>\$1,173,394</i>	<i>\$3,222,796</i>	<i>\$666,061</i>	<i>\$3,180,903</i>	<i>\$305,721</i>	<i>\$377,988</i>	<i>\$13,691,552</i>
Allocated Expense									
Route Operations	\$135,876		\$105,985	\$68,679	\$66,844	\$17,093	\$25,352		\$419,829
Mgmt. & Planning	\$108,063	\$90,254	\$65,373	\$272,726	\$9,665	\$99,919	\$911		\$646,910
Prog Admin & MSC	\$174,179	\$145,474	\$105,371	\$439,589	\$15,578	\$161,052	\$1,468		\$1,042,712
Customer Service	\$81,527	\$81,527	\$81,527	\$10,735	\$10,735				\$266,050
Outreach		\$90,837							\$90,837
<i>Allocated Subtotal</i>	<i>\$499,645</i>	<i>\$408,091</i>	<i>\$358,256</i>	<i>\$791,730</i>	<i>\$102,822</i>	<i>\$278,063</i>	<i>\$27,731</i>		<i>\$2,466,337</i>
Total Expense	\$2,434,732	\$3,237,695	\$1,531,650	\$4,014,526	\$768,882	\$3,458,966²	\$333,451	\$377,988	\$16,157,889

Notes:

1. Contracted commingled cart collection is provided to single-family and multi-family residents and businesses. Approximately 9% of the customers are businesses.
2. Processing costs do not include the material value received for the recyclables, which is recognized by the City as a revenue and varies based on commodity markets. In FY2018, material value credits resulted in an offset of \$794,254 of the processing cost.
3. Subtotals may not sum exactly to totals due to rounding.

**SECTION 4
 RESIDENTIAL COST OF SERVICE**

Residential Service Cost Overview

Residential service is the weekly collection of waste, recycling, and compost from single-family (1 and 2 unit) homes. Standard service¹ includes a 64-gallon cart for trash, a 64-gallon cart for recycling, and compost collection in either bags or a 96-gallon cart. Approximately 90% of Ann Arbor residents have one 64-gallon cart for waste, with the remainder either having a 32 or 96-gallon cart or multiple carts.

Table 4 summarizes the cost of residential service for a resident with a 64-gallon cart for waste, a 64-gallon cart for recycling, and a 96-gallon cart for compost. Table 4 also includes the cost for collection and disposal of waste from City events, downtown street-side containers, and bulky waste. In communities where residential collection service is provided under contract by a private hauler, these collection costs are often embedded in the residential monthly rate. Therefore, for purposes of comparison to other communities, these costs are included here, with the FY2018 cost distributed over the City’s 26,247 residential units.

TABLE 4. RESIDENTIAL WASTE, RECYCLING, AND COMPOST COST OF SERVICE PER HOUSEHOLD

Service	Monthly Cost per HH
Residential Waste Collection and Disposal	\$7.67
Residential Compost Collection and Composting	\$4.83
Commingled Cart Recycling Collection and Processing	\$15.54
City Events / Downtown Street-side Cans / Bulky Waste	\$1.06
Total Cost of Service	\$29.09
Annual Cost (Total Cost x 12 months)	\$349.09

The subsequent tables provide a more detailed cost analysis to identify the component costs of each service: waste collection, compost, and recycling. Component costs include labor, fuel, truck repair and maintenance, truck capital, post-collection activities (disposal, composting, or processing), and allocated administrative costs.

Residential Waste Collection and Disposal

Table 5 provides a detailed breakdown of costs for residential waste collection and disposal by cost component. Additional detail is provided in the notes to Table 5, including the calculations completed

¹ Residents may opt for 32-gallon or 96-gallon cart sizes for trash and recycling, or 64-gallon cart for compost.

to derive the monthly cost per household contributed by each cost component. The notes correspond to the letters identified in the first column of Table 5.

TABLE 5. RESIDENTIAL WASTE COLLECTION AND DISPOSAL COST OF SERVICE				
Note	Cost Component	Count / Unit Cost	Unit	Cost / Household / Month
Route Parameters				
A	Residential Customers	26,247	customers	
	Truck Route Hours (Total)	12,789	hours	
	Weekly Routes	6	routes	
	Truck Route Hours per Route	2,132	hours	
	Customer Pick-Ups per Hour	107	customers per hour	
Labor Cost				
B	Labor Cost per Hour	\$31.70	per hour	
	Benefit %	96.1%	% of labor cost	
	Total Labor Cost	\$62.17	per hour	\$2.52
Fuel Cost				
C	Average Fuel Consumption	6,116	gallons	
	Fuel Cost (\$ per gallon)	\$2.93	\$ per gallon	
	Annual Fuel Cost	\$17,916	per year	
	Per Route Hour Cost	\$8.41	per hour	\$0.34
Truck Repair and Maintenance Cost				
D	Truck Repair and Maintenance Cost	\$342,471	per year	
	Per Route Hour Cost	\$26.78	per hour	\$1.08
Disposal Cost				
E	Residential Waste Tons	15,017	tons per year	
	Monthly Set Out Weight	95.36	lbs / hh / month	
	Disposal Cost per Ton	\$25.45	per ton	
	Monthly Disposal Cost	\$1.21	per hh / month	\$1.21
Truck Cost				
F	2014 Mack LEU613 (Typical)	\$278,443	per truck	
	Replacement Cost (+3% per year)	\$342,450	per truck	
	Annual Cost (7 year life)	\$48,921	per truck per year	
	Truck Cost Per Route Hour	\$22.95	per hour	\$0.93
Direct Cost, Residential Solid Waste				\$6.08
Allocated Administrative Costs				
G	Supervisor / Ops Cost	\$135,876	per year	\$0.43
	Mgmt. & Planning	\$108,063	per year	\$0.34
	Administrative & Municipal Services	\$174,179	per year	\$0.55
	Customer Service	\$81,527	per year	\$0.26
Allocated Administrative Cost, Residential Solid Waste				\$1.59
Total Residential Solid Waste Cost				\$7.67

TABLE 5. RESIDENTIAL WASTE COLLECTION AND DISPOSAL COST OF SERVICE

Notes to Table 5 (subtotals may not sum exactly to totals due to rounding):

A	Total labor hours were provided by the City. On-route hours, or truck hours, were assumed to be 95% of labor hours. The remaining 5% of labor hours are considered to be non-productive time for activities such as pre- and post-trip inspections. Based on the labor hours worked, the average automated side load collection truck is on-route 2,132 hours annually. Productivity averages 107 customers per hour. When compared to other municipal collection operations from prior cost of service studies, the City has a reasonable level of productivity.
B	The City's full labor cost is based on an average hourly labor cost of \$31.70 plus 96.1% for tax and benefit costs. Dividing the labor cost per hour by the customers per hour yields the labor cost per customer per week, which is converted to a monthly cost by multiplying by the average number of weeks per month. Full labor cost = \$62.17 per hour = \$31.70 x (1+.961) Monthly cost = \$2.52/hh/month = (\$62.17 per hour / 107 customers per hour) x 4.33 weeks/month
C	The average fuel cost per truck was \$17,916 in FY2018. Monthly cost = \$0.34/hh/month = (\$17,916 per truck / 2,132 route hours per truck) / 107 customers per hour x 4.33 weeks/month
D	The total cost for truck repair and maintenance was \$342,471 in FY2018. Monthly cost = \$1.08/hh/month = (\$342,471 / 12,789 total truck hours) / 107 customers per hour x 4.33 weeks/month
E	Waste collected from the residential routes was 15,017 tons in FY2018. The disposal cost was \$25.45 per ton. Avg. monthly set-out per customer = 95.36 pounds = (15,017 tons x 2,000 pounds/ton / 12 months) / 26,247 customers Monthly disposal cost = \$1.21/hh/month = (95.36 pounds / 2,000 pounds/ton) x \$25.45/ton
F	The current automated collection truck replacement cost is \$342,450. Using the City's method for truck replacement, the annual truck cost is the cost of the truck purchased, plus a 7-year 3% annual compounding cost, divided over the 7-year life of the collection truck. Annual truck cost = \$48,921 per year = (\$342,450 replacement cost / 7 year life) Monthly truck cost = \$0.93/hh/month = (\$48,921 / 2,132 route hours/week) / 107 customers/hour x 4.33 weeks/month
G	Allocated administrative costs for route supervisor operations, management and planning, administrative and internal municipal services, and customer service total \$499,645. Monthly administrative cost = \$1.59/hh/month = (\$499,645 per year / 26,247 customers) / 12 months/year.

Residential Compost Collection and Composting

Compost collection and composting costs were calculated utilizing the same method as residential waste collection costs. Compost service varies slightly in that direct costs of collection (labor, fuel, repair and maintenance, composting) are only incurred during 9 months of the year, while fixed costs (truck costs including seasonal truck rental, facility depreciation, and administrative costs) are incurred over the entire 12-month year. Costs are therefore calculated and denoted as either 9-month or 12-month costs in Table 6.

Table 6 provides a detailed breakdown of costs for residential compost collection and composting by cost component. Additional detail is provided in the notes to Table 6, including the calculations completed to derive the monthly cost per household contributed by each cost component. The notes correspond to the letters identified in the first column of Table 6.

TABLE 6. RESIDENTIAL COMPOST COLLECTION AND COMPOSTING COST OF SERVICE				
Note	Cost Component	Count / Unit Cost	Unit	Cost / Household / Month
Route Parameters				
A	Residential Customers	26,247	customers	
	Truck Route Hours (Total)	9,431	hours	
	Weekly Routes	4	routes	
	Truck Route Hours per Route	2,358	hours	
	Customer Pick Ups per Hour	103	customers per hour	
Labor Cost				
B	Labor Cost per Hour	\$29.55	per hour	
	Benefit %	28.0%	% of labor cost	
	Total Labor Cost	\$37.82	per hour	\$1.59 (9 months)
Fuel Cost				
C	Average Fuel Consumption	4,926	gallons	
	Fuel Cost (\$ per gallon)	\$2.93	\$ per gallon	
	Annual Fuel Cost	\$14,430	per year	
	Per Route Hour Cost	\$6.12	per hour	\$0.26 (9 months)
Truck Repair and Maintenance Cost				
D	Truck Repair and Maintenance Cost	\$50,248	per route per year	
	Per Route Hour Cost	\$5.33	per hour	\$0.22 (9 months)
Compost Cost				
E	Residential Compost Tons	9,085	tons per year	
	Monthly Set Out Weight	76.92	lbs / hh / month	
	Compost Cost per Ton	\$18.95	per ton	
	Monthly Compost Cost	\$0.73	per hh / month	\$0.73 (9 months)
Truck Cost				
F	2010 Mack w/Labrie Packer (Typical)	\$265,672	per truck	
	Replacement Cost (+3% per year)	\$326,743	per truck	
	Annual Cost (7 year life)	\$46,678	per truck per year	
	Truck Cost Per Route Hour	\$19.80	per hour	\$0.83 (12 months)
Seasonal Truck Rental Cost				
G	Truck Rental	\$141,011	per year	\$0.45 (12 months)
Facility Depreciation				
H	Compost Facility Depreciation	\$97,120	per year	\$0.31 (12 months)
Direct Cost, Residential Compost				\$3.72 (12 months)
Allocated Administrative Costs				
I	Supervisor / Ops Cost	\$105,985	per year	\$0.34 (12 months)
	Mgmt. & Planning	\$65,373	per year	\$0.21 (12 months)
	Administrative & Municipal Services	\$105,371	per year	\$0.34 (12 months)
	Customer Service	\$81,527	per year	\$0.26 (12 months)
Allocated Administrative Cost, Residential Compost				\$1.14 (12 months)
Total Residential Compost Cost				\$4.83 (12 months)

TABLE 6. RESIDENTIAL COMPOST COLLECTION AND COMPOSTING COST OF SERVICE

Notes to Table 6 (subtotals may not sum exactly to totals due to rounding):

The overall 12-month cost per customer was calculated by summing all monthly costs and multiplying by 9 months, then summing costs denoted as 12-month costs and multiplying by an additional 3 months. The total annual cost was then divided by 12 months to calculate an average monthly cost on a 12-month basis.

A	Total labor hours were provided by the City. On-route hours, or truck hours, were assumed to be 95% of labor hours. The remaining 5% of labor hours are considered to be non-productive time for activities such as pre- and post-trip inspections. Based on the labor hours worked, the average compost collection truck is on-route 2,358 hours annually over the 9-month program. Productivity averages 103 customers per hour.
B	The City's total labor cost is based on an average hourly labor cost of \$29.55 plus 28.0% for tax and benefit costs. This labor cost includes full-time City employees as well as temporary labor positions, temporary labor positions were used more extensively during FY2018 in this program area. Dividing the labor cost per hour by the customers per hour yields the labor cost per customer per week, which is converted to a monthly cost by multiplying by the average number of weeks per month. Total labor cost = \$37.82 per hour = \$29.55 x (1+.280) Monthly cost = \$1.59/hh/month = (\$37.82 per hour / 103 customers per hour) x 4.33 weeks/month
C	The average fuel cost per truck was \$14,430 in FY2018. Monthly cost = \$0.26/hh/month = (\$14,430 per truck / 2,358 route hours per truck) / 103 customers per hour x 4.33 weeks/month
D	The total cost for truck repair and maintenance was \$50,248 in FY2018. Monthly cost = \$0.22/hh/month = (\$50,248 / 9,431 total truck hours) / 103 customers per hour x 4.33 weeks/month
E	Compost collected from residential routes was 9,085 tons in FY2018. The composting cost was \$18.95 per ton. Avg. monthly set-out per customer = 76.92 pounds = (9,085 tons x 2,000 pounds/ton / 9 months) / 26,247 customers Monthly composting cost = \$0.73/hh/month = (76.92 pounds / 2,000 pounds/ton) x \$18.95/ton
F	The current automated collection truck replacement cost is \$326,743. Using the City's method for truck replacement, the annual truck cost is the cost of the truck purchased, plus a 7-year 3% annual compounding cost, divided over the 7-year life of the truck. Annual truck cost = \$46,678 per year = (\$326,743 replacement cost / 7 year life) Monthly truck cost = \$0.83/hh/month = (\$46,678 / 2,358 route hours) / 103 customers/hour x 4.33 weeks/month
G	Truck rental includes costs to rent additional trucks during the fall leaf collection season.
H	Depreciation represents allocated costs for development and improvement of the compost facility.
I	Allocated administrative costs for route supervisor operations, management and planning, administrative and internal municipal services, and customer service total \$358,256. Monthly administrative cost = \$1.14/hh/month = (\$358,256 per year / 26,247 customers) / 12 months/year.

Commingled Cart Recycling Collection and Processing

The City contracts with Recycle Ann Arbor for cart-based collection of recyclables. While this service is primarily provided to residential customers, Recycle Ann Arbor also provides collection of commercial recycling carts outside of the downtown area. These commercial customers are served on the regular residential routes, and therefore costs for cart recycling collection provided under contract are not segregated by residential or commercial costs. Costs are calculated per customer, inclusive of the commercial customers in addition to residential customers. Recycle Ann Arbor's

contracted collection cost equates to labor costs associated with collection. The City provides the carts, collection trucks and the costs to operate and maintain the fleet.

Table 7 provides a detailed breakdown of costs for commingled cart recycling collection and processing by cost component. Additional detail is provided in the notes to Table 7, including the calculations completed to derive the monthly cost per household contributed by each cost component. The notes correspond to the letters identified in the first column of Table 7.

TABLE 7. COMMINGLED CART RECYCLING COLLECTION AND PROCESSING COST OF SERVICE				
Note	Cost Component	Count / Unit Cost	Unit	Cost / Customer / Month
Route Parameters				
	Residential Customers	26,247	customers	
	Commercial Customers	2,539	customers	
	Total Commingled Cart Customers	28,786	customers	
Labor Cost				
A	Contracted Collection Cost	\$1,736,689	per year	
	Monthly Contracted Collection Cost	\$144,724	per month	\$5.03
City-Owned Truck Operations Cost				
B	Recycling Truck Operations	\$84,069	per year	
	Fuel	\$98,110	per year	
	Repair and Maintenance	\$517,662	per year	
	Annual Cost (subtotal)	\$699,841	per year	
	Per Route Hour Cost	\$26.78	per hour	\$2.03
Truck Cost				
C	City Fleet Charge	\$387,456	per year	\$1.12
Processing Cost				
D	Collected Recycling Tons	10,566	tons per year	
	Monthly Set Out Weight	61.4	lbs / hh / month	
	Processing and City MRF Cost	\$255.27	per ton	
	Less, Material Value	\$(53.17)	per ton	
	Net Processing Cost	\$202.10	per ton	
	Monthly Processing Cost	\$6.18	per cust. per month	\$6.18
Direct Cost, Commingled Cart Recycling				\$14.36
Allocated Administrative Costs				
E	Mgmt. & Planning	\$90,254	per year	\$0.26
	Administrative & Municipal Service	\$145,474	per year	\$0.42
	Customer Service	\$81,527	per year	\$0.24
	Outreach	\$90,837	per year	\$0.26
Allocated Administrative Cost, Commingled Cart Recycling				\$1.18
Total Commingled Cart Recycling Cost				\$15.54

Notes to Table 7 (subtotals may not sum exactly to totals due to rounding):

A	In FY2018, Recycle Ann Arbor invoiced \$1,736,689 for collection of cart recycling to residents and businesses. This includes labor but not the cost of City-provided trucks. Monthly cost = \$5.03/customer/month = (\$1,736,689 per year / 28,786 customers) / 12 months/year
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TABLE 7. COMMINGLED CART RECYCLING COLLECTION AND PROCESSING COST OF SERVICE

B	<p>Equipment, materials and supplies, fuel, and repair and maintenance totaled \$699,841 for the year. Monthly cost = \$2.03/customer/month = (\$699,841 per year / 28,786 customers) / 12 months/year</p>
C	<p>The City incurred \$387,456 in truck costs charged by the City's fleet department for the trucks assigned to collect recycling. Monthly cost = \$1.12/customer/month = (\$387,456 per year / 28,786 customers) / 12 months/year</p>
D	<p>Processing costs for the collected materials are based on the total cost to process commingled materials (see Table 8). In addition to processing, the City also incurs costs for its MRF and the associated labor to maintain the facility. Processing costs are detailed in Section 5 and Table 8 of this report. The net cost per ton was \$204.02 and recycling collected was 10,566 tons. Avg. monthly set-out per customer = 61.2 pounds = (10,566 tons x 2,000 pounds/ton / 12 months) / 28,786 customers Monthly cost = \$6.18/customer/month = (61.2 pounds / 2,000 pounds/ton) x \$202.10/ton</p>
E	<p>Allocated administrative costs for management and planning, administrative and internal municipal services, customer service, and outreach total \$408,091. Monthly administrative cost = \$1.18/customer/month = (\$408,091 per year / 28,786 customers) / 12 months/year.</p>

SECTION 5

RECYCLABLE MATERIAL PROCESSING COST OF SERVICE

The City contracts with Recycle Ann Arbor for the processing of commingled recyclable material collected from both residents and businesses; Recycle Ann Arbor has subcontracted with Rumpke Waste and Recycling Services (Rumpke) for processing of recyclables. The contract cost is \$157.30 per ton which includes transfer haul from the City's MRF (MRF) to Rumpke's Cincinnati processing facility for processing. Source separated cardboard delivered to the City's MRF is handled separately and transported to a local facility for recycling at a reduced cost per ton compared to commingled recyclables. In addition, the City incurs costs for MRF oversight, MRF repair and maintenance, utility costs, and MRF depreciation. The processing cost is reduced by the value of the sorted material, which fluctuates monthly based on market prices, and is provided to the City as a credit on Recycle Ann Arbor's processing invoices.

Table 8 details the cost of service calculation for recycling transport and processing for commingled single-stream residential and commercial single-stream materials. Costs were allocated based on the invoiced tonnages for single-stream and commercial cardboard tons from the Recycle Ann Arbor invoices. The recyclables credit is based on the average material value per ton each month, applied to the composition of the City's recyclables (which are audited on a periodic basis).

TABLE 8. COST OF SERVICE FOR RECYCLING PROCESSING

Contractor Invoice Data	Single-Stream	Commercial Cardboard	Total / Weighted Average
Invoiced Processing Cost (RAA / Rumpke)	\$1,972,869	\$125,805	\$2,098,674
City MRF Cost (Depreciation, Utilities, Maintenance)	\$1,228,712	\$131,580	\$1,360,291
Gross Recycling Cost	\$3,201,581	\$257,385	\$3,458,966
Annual Invoiced Material Tons	12,542	1,343	13,885
Processing Cost per Ton	\$157.30	\$93.67	\$151.14
City MRF Cost per Ton	\$97.97	\$97.97	\$97.97
Gross Recycling Cost per Ton	\$255.27	\$191.63	\$249.11
Recyclables Credit (FY2018 Actual)	\$(666,819)	\$(127,435)	\$(794,254)
Recyclables Credit per Ton (Average, FY2018)	\$(53.17)	\$(94.88)	\$(57.20)
Net Recycling Cost	\$2,534,761	\$129,950	\$2,664,711
Net Recycling Cost per Ton	\$202.10	\$96.75	\$191.91

Table 8 presents the average cost of service for recycling processing in FY2018. However, it is important to note that the monthly material value per ton over the 12-month period declined from \$79.22 per ton in July 2017 to \$34.78 in June 2018. Table 9 summarizes the net processing cost of

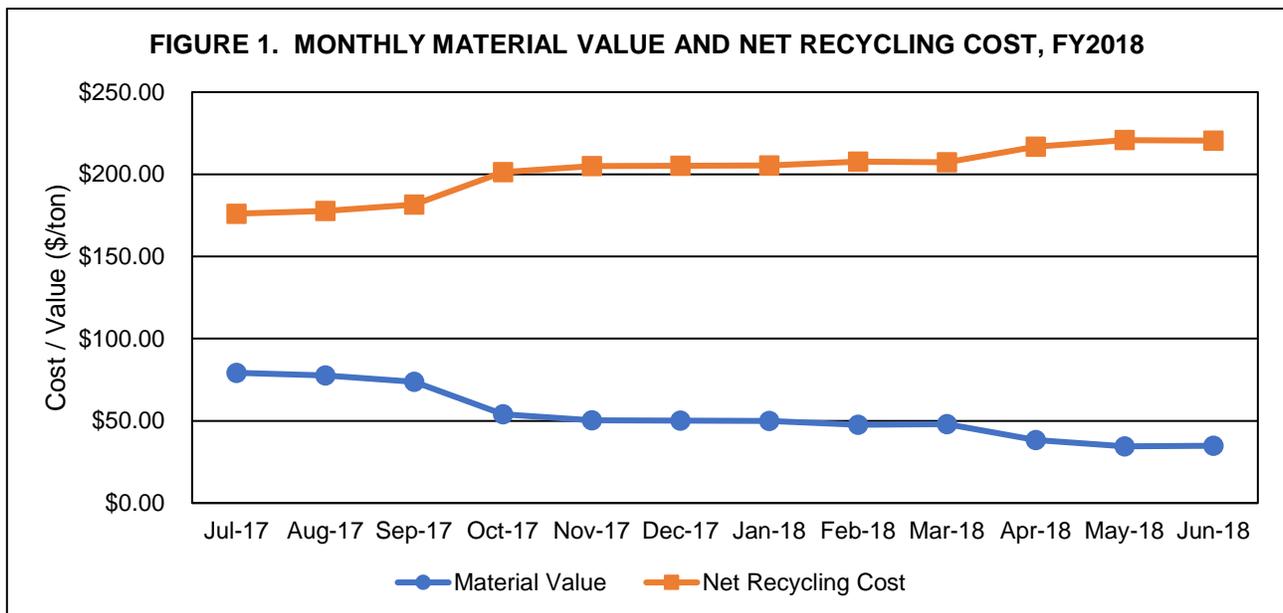
the commingled mix on a monthly basis in FY2018, and Figure 1 graphically summarizes the trends in material value and net cost per ton. Based on material value at the end of FY2018, the net cost per ton to process single stream recycling was \$220.49, approximately 10% higher than the average cost in FY2018 and 25% higher than the cost at the start of FY2018. Intra-year changes in material value can therefore have a significant impact on costs of service.

TABLE 9. MONTHLY COST OF PROCESSING SINGLE STREAM RECYCLING IN FY2018

Month	Processing Cost per Ton	City MRF Cost per Ton	Less Material Value per Ton	Net Cost per Ton
July-17	\$157.30	\$97.97	\$(79.22)	\$176.05
August-17	\$157.30	\$97.97	\$(77.66)	\$177.61
September-17	\$157.30	\$97.97	\$(73.79)	\$181.48
October-17	\$157.30	\$97.97	\$(54.00)	\$201.27
November-17	\$157.30	\$97.97	\$(50.28)	\$204.99
December-17	\$157.30	\$97.97	\$(50.06)	\$205.21
January-18	\$157.30	\$97.97	\$(49.87)	\$205.40
February-18	\$157.30	\$97.97	\$(47.64)	\$207.63
March-18	\$157.30	\$97.97	\$(47.94)	\$207.33
April-18	\$157.30	\$97.97	\$(38.39)	\$216.88
May-18	\$157.30	\$97.97	\$(34.49)	\$220.78
June-18	\$157.30	\$97.97	\$(34.78)	\$220.49

Note:

1. City MRF Cost includes MRF oversight, repair and maintenance, utility costs, and depreciation.
2. Subtotals may not sum exactly to totals due to rounding.



SECTION 6

COMMERCIAL COLLECTION COST OF SERVICE

Commercial collection includes periodic (weekly or more frequent) collection of waste and recycling from multi-family properties of 3 units or more and businesses and institutions. Commercial collection service levels vary and include differences in container size (from 64-gallon carts to 40-cubic yard containers) and collection frequency (from once per week to 6-days per week).

Commercial service consists of the following activities and related costs:

- Picking up the waste or recycling container and emptying the contents into the collection truck;
- Delivering the collected material to the City's transfer station (for waste) or material recovery facility (for recyclables); and
- Invoicing commercial customers for the service (for waste).

These three actions have unit costs that are combined to calculate an overall cost of commercial service. Service providers and the type of service provided by each were identified in Table 1 and are summarized as follows:

- City crews provide three types of commercial collection: rear-load collection of solid waste carts; front-load (dumpster) collection of solid waste from multi-family units that own their own front-load container; and, recycling collection for businesses that generate enough material to require a front-load dumpster, or are located in the downtown area.
- Waste Management, through its commercial waste collection franchise agreement with the City, provides waste collection to businesses and multi-family properties that require a front-load container and for which Waste Management provides the container.
- Recycle Ann Arbor provides recycling collection service to multi-family properties and businesses that utilize a cart for collection of commingled recyclables. These costs were calculated in Table 7.

Table 10 details the cost of service for each commercial collection function. Total commercial collection costs from Table 3 have been segregated by the specific function to calculate the cost of service. Disposal and recycling processing costs are based on the quantity of material collected, which varies based on container size and collection frequency; these costs are calculated in Table 11.

TABLE 10. DETAILED COSTS FOR COMMERCIAL COLLECTION SERVICES

Expense Type	Rear Load Waste	Multi-Family Waste	Front Load Recycling	Front Load Waste (WM)
Collection Cost				
Labor	\$187,582	\$178,286	\$298,189	
Operations	\$1,426		\$19,411	
Depreciation	\$33,780	\$68,185	\$80,052	
Vehicle Rental	\$546		\$61,240	
Vehicle Repair & Maintenance	\$12,610	\$132,832	\$93,038	
Fuel	\$6,665	\$30,798	\$21,191	
Equipment		\$4,193	\$10,629	
Utility	\$23	\$674		
Contracted Services			\$82,311	\$1,585,679
<i>Collection Cost Subtotal</i>	<i>\$242,632</i>	<i>\$414,968</i>	<i>\$666,061</i>	<i>\$1,585,679</i>
Administrative Cost				
Route Operations	\$33,895	\$34,784	\$66,844	
Mgmt. & Planning	\$8,640	\$66,341	\$9,665	\$197,745
Admin & Municipal Service	\$13,926	\$106,931	\$15,578	\$318,732
Customer Service	\$1,407	\$1,838	\$10,804	\$7,559
<i>Administrative Cost Subtotal</i>	<i>\$57,868</i>	<i>\$209,894</i>	<i>\$102,891</i>	<i>\$524,037</i>

Table 11 details the cost of service for each City-provided commercial and multi-family service. Notes providing further explanation of the calculated costs are provided following the table, with each note denoted by letter in the first column of Table 11.

TABLE 11. COMMERCIAL COLLECTION COST OF SERVICE

Note	Description / Cost	Rear Load Waste	Multi-Family Waste	Front Load Recycling	Front Load Waste (WM)
A	Collection Cost	\$242,632	\$414,968	\$666,061	\$1,585,679
B	Annual Lifts	58,292	37,284	20,436	75,838
C	Cost per Lift	\$4.16	\$11.13	\$32.59	\$9.33
D	Collected Container Tons	1,201	9,219	3,320	27,480
E	Annual Container Yards Serviced	27,567	223,756	81,744	517,903
F	Density (Pounds per Yard)	87.11	82.40	81.22	106.12
G	Disposal / Processing Cost per Yard	\$1.11	\$1.05	\$6.48	\$1.35

TABLE 11. COMMERCIAL COLLECTION COST OF SERVICE

H	Administrative Cost	\$57,868	\$209,894	\$102,891	\$524,037
I	Customer Count	150	196	393	806
J	Monthly Admin Cost per Customer	\$32.15	\$89.24	\$21.82	\$54.18
K	Monthly Cost - 96-gal Cart (1x/wk)	\$52.44			
L	Monthly Cost - 2-yard Container (1x/wk)		\$146.51	\$219.03	\$106.26

Notes to Table 11 (subtotals may not sum exactly to totals due to rounding):

A	Collection Cost is the Total Collection Cost from Table 10
B	Annual container lifts obtained from City route sheets and customer summaries
C	Cost per Lift = Collection Cost (A) divided by Annual Lifts (B)
D	Collected Container Tons obtained from City scalehouse data
E	Annual Container Yards Serviced obtained from City route sheets
F	Density (Pounds per Yard) = Collected Container Tons x 2,000 pounds per ton / Annual Container Yards (D x 2,000 / E)
G	Disposal / Processing Cost per Yard = Density (Pounds per Yard) / 2,000 pounds per ton x the SW tip fee (\$25.45) or the processing cost per ton (\$159.57; this is a blended cost based on the commercial cardboard cost and the single stream cost)
H	Administrative Cost is the Administrative Cost Subtotal from Table 10
I	Customer Counts by function were provided by City staff
J	The Monthly Admin Cost per Customer = Administrative Cost / 12 months / Customer Count (H / 12 months / I)
K	The cost of service calculation is: (Cost per Lift (C) x lifts per week x 4.33 weeks/month) + ((96 gal cart / 203 gals/yd.) x (Disposal Cost per Yard (G) x lifts per week x 4.33 weeks/month)) + Monthly Admin Cost (J)
L	The cost of service calculation is: (Cost per Lift (C) x lifts per week x 4.33 weeks/month) + (2 yds. x Disposal Cost per Yard (G) x lifts per week x 4.33 weeks/month) + Monthly Admin Cost (J)

Commercial Cost Comparisons

Excluding City administrative costs, the monthly cost of collection and disposal for commercial rear load service is \$20.29 (\$52.44 - \$32.15) per 96-gallon cart. The City's commercial cart collection cost is higher than residential cart collection (calculated to be \$6.08 per month excluding administrative costs). The increased cost for commercial cart collection can be explained by the differences in service density, automation and access. The City's rear-load routes outside of the downtown are less dense than the residential collection routes, resulting in greater cost per customer. Rear load collection also requires more service time per stop for the driver to start, stop, exit the truck, and dump the cart compared to an automated side load residential cart collection that does not require the driver to exit the truck. In addition, commercial rear load routes are typically in tight access areas, particularly in the downtown area, requiring more maneuvering and slower travel between stops.

Again excluding administrative costs and considering only direct costs, the collection cost for the City’s front load service is also higher than Waste Management’s rate for similar service under the commercial franchise agreement. Waste Management’s average price to the City per lift is \$9.33. This price is inclusive of Waste Management’s costs for labor, truck capital, truck operating and maintenance, administration, and profit; the cost of the container has been factored out because the container cost varies by size while the lift cost is largely constant and not dependent on container size. Excluding an assumed 15% profit margin from Waste Management’s cost, Waste Management’s estimated cost per lift for front load collection is \$7.93 ($\$9.33 \times (1 - 15\%)$). Table 12 compares Waste Management’s collection costs per lift to the City’s front load collection cost per lift.

TABLE 12. COMPARATIVE COMMERCIAL COLLECTION COSTS		
Provider	Average Cost per Lift	Variance vs. WM
Waste Management	\$9.33	
Waste Management (profit removed)	\$7.93	
City Front-Load Solid Waste	\$11.13	\$1.80 (+19%) / \$3.20 (+40%)
City Front-Load Recycling	\$32.59	\$23.26 (+249%) / \$24.66 (+311%)

The difference in the cost between the City and Waste Management can be explained by a number of reasons:

1. Waste Management’s service is provided with greater route density than the City’s services. Waste Management provides collection to 806 customers Citywide, compared to 196 customers served by the City for front-load solid waste collection. The greater route density results in more efficient, lower cost collection per lift.
2. Waste Management utilizes dynamic routing combined with on-board systems that increase collection efficiency by charting the shortest distance between each stop. The City currently uses hand-drawn maps for routing and has not optimized its routes.
3. Waste Management’s administrative costs embedded in its cost per lift are low due to consolidation of systems within the corporation and allocation of administrative costs across a large, national customer base.
4. Because of its size and the number of collection trucks and containers it purchases, Waste Management receives a substantial discount on trucks and containers compared to the costs paid by small quantity purchasers.
5. The City has not established standards or requirements for collection performance and does not measure such metrics. Private companies, including Waste Management, track and evaluate various performance metrics to optimize efficiency.

SECTION 7

PROGRAM AREA REVENUE

Revenue for the operation of the City's resource management program is generated primarily from a property tax levy, with additional revenue provided by fees for services, recyclable commodity value, royalties on third party tonnage accepted at the transfer station and compost facility, and payments on the sale of finished compost. In FY2018, the program area generated \$16,675,449 in revenue from the following sources:

- Refuse levy: \$12,635,609 of revenue (76% of total revenue), based on a FY2018 tax rate, or millage rate, of 2.4134 mills. The millage rate is applied to every \$1,000 of assessed value of each property. Based on the taxable valuation of properties in FY2018, approximately 65.5% of the taxable value was assigned to residential-classed properties² and 35.5% was assigned to commercial and industrial-classed properties. Therefore, residential property millage revenue was approximately \$8,276,000 and commercial property millage revenue was approximately \$4,486,000 in FY2018. By comparison, the cost of residential services in FY2018 was approximately \$9,500,000, and the cost of commercial services was approximately \$6,300,000.
- Fees for services: \$2,892,296 of revenue (17% of total revenue). Service fees include charges for commercial waste collection, residential cart upgrades, additional container tips, or other additional services.
- Royalties and revenue shares not covered under the levy or captured through service fees, and other miscellaneous sources: \$1,147,544 of revenue (7% of total revenue); this amount is subject to greater variability from year to year based on commodity markets and the flow of third party tonnage to the City's transfer station and compost facility.

² Owner-occupied properties typically claim the Principal Residence Exemption (PRE); properties that are not owner-occupied (such as investment and rental properties) are not eligible for the PRE. By value, residential-classed properties claiming the PRE represent 52.5% of total taxable value, and non-PRE properties represent 13% of the total taxable value.

SECTION 8 CONCLUSION

Based on total operations expenses of \$16,157,889 (Table 3) and revenues of \$16,675,449 (Section 7), the City's solid waste operations costs were covered by the various revenue streams received in FY2018, resulting in a small operations surplus (\$517,560, or approximately 3%) in FY2018. However, adjustments to the City's expenses are also made annually. Though they are not direct cash expenses, these adjustments impact the Solid Waste Fund balance equity, either positively or negatively. The adjustments may include:

- Pension (GASB) and retiree benefit (OPEB) funding based on the number and pay scale of current employees for the program area
- Landfill closure and post-closure care liability adjustments based on engineer's cost estimates
- Capital asset adjustments
- Future Generally Accepted Accounting Practices (GAAP) requirements

While these costs are not driven by current solid waste operations, they are direct obligations charged to the Solid Waste Fund equity. In recent years, large adjustments have occurred to initially fund retiree benefit accounts, recognize the pension liability, and fund the landfill closure liability, each resulting in negative impacts to the Fund balance. In FY2018 these adjustments to the Solid Waste Fund equity totaled \$2,394,035, exceeding the \$517,560 surplus noted above by \$1,876,475, resulting in a reduction in the Solid Waste Fund balance. Therefore, the program area experienced a net loss of nearly \$2 million in the Solid Waste Fund equity in FY2018. Though these adjustments may be more modest in some years, they may also be large as was experienced in FY2018.

Other factors also impact Fund sustainability. For example, during FY2018 there was a greater utilization of temporary labor than typical, evidenced by the calculated residential compost collection costs that resulted in lower program costs than can typically be anticipated. In addition, because revenues include streams that are subject to variation (such as royalties on third party waste at the transfer station and recyclables material credits), this surplus could be narrowed or negated and result in a deficit in other years. For example, the material value of single-stream recyclables declined \$44.44 per ton from the beginning to the end of FY2018. Had material value been at the lower end-of-FY2018 value all year, the recyclables credit would have been reduced by \$557,366 and a deficit in the operations portion of the Solid Waste Fund performance would have been experienced.

This cost of service analysis provides a sound understanding of costs and cost drivers within the City's current programs. It also identifies that, though there is a positive Fund balance, a number of factors impact the long-term sustainability of the Fund and limit its use. The analysis provides the basis to evaluate costs of options being considered in the Solid Waste Resources Management Plan; provides baseline data to evaluate funding methods in the Plan (including additional revenues or cost savings necessary to implement and sustain program expansions or additions); and will be a useful tool for the City when developing annual budgets, monitoring operations and financial performance, and ensuring the Solid Waste Fund is able to absorb annual adjustments.