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ASHEVILLE – PAY AS YOU THROW (PAYT) OPTIONS: SENSITIVITY ANALYSIS

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*Prepared for:
City of Asheville*

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1. EXECUTIVE SUMMARY

Project Background

The City of Asheville is considering introducing a Pay As You Throw (PAYT) option for trash services to achieve several objectives:

- Increase recycling and diversion
- Provide a more equitable and incentive-based fee structure
- Provide a clear and potentially dedicated revenue source for solid waste services
- Provide options for lower service levels for customers on fixed income and others who need less service

The City hired Skumatz Economic Research Associates (SERA) to conduct a **feasibility study and analysis of PAYT options** for the City. Per the City's request, SERA conducted an analysis of two main options:

- **Bag-based system**, which had been introduced to the Council in presentations by WasteZero™, a Raleigh-NC-based private firm that manufactures and sells and distributes bags, and promotes PAYT.¹
- **Cart-based system**, a PAYT program used commonly in communities across the US with automated collection.²

SERA prepared a report in December 2015 that made several main conclusions:

- **Carts are a cheaper system for residents.** The cart-based system would cost customers less than the bag-based program, and that payback period is shorter than 5 years. That is, if a bag program is introduced, households will pay extra for the logoed bags forever. That extra cost adds up to more than the total cost of the carts within 5 years. Given that the carts generally last 15 plus years, households save for the last 10 plus years.
- A 2015 Asheville customer survey showed **residents in Asheville preferred the cart-based option.**
- Recycling rates may be marginally higher under a bag system (although this assumption cannot be statistically validated), but the **cost is lower for residents than the cart-based program.**
- Given that user fees currently contribute only about 50% of the cost of service, if the City is to achieve full cost recovery, household solid waste rates will need to increase. The **cost increase to achieve full-cost-recovery is lower under a cart-based PAYT system** than under a bag-based option.

Critique and Revised Conclusions

After conducting a detailed review of SERA's report, WZ issued a response critical of several aspects of SERA's report, focused on data and assumptions, and the conclusions drawn. The remainder of this report addresses the criticisms and demonstrates that the conclusions drawn by the SERA study hold

¹ The firm notes in its critique that it has "... invested hundreds of hours on the ground in Asheville...".

² SERA also considered a "hybrid" PAYT system for Asheville, but noted on page 18 that the base cart size in Asheville did not lend itself to the economies of a hybrid system.

through a wide range of values and assumptions. **The sensitivity analysis shows bags remain a more costly choice for Asheville residents.**

The question boils down to whether various assumptions can make up for the substantially higher costs for special bags, purchased week after week forever, compared to the cost of a \$55 cart with a 15-plus year life.

Under a series of assumption changes (even incorporating aggressive suggestions from WZ), **we find that the cost of the bag program is always greater to residents than the cost of the cart-based PAYT program** – the core result of the feasibility study. We still find that the cart-based PAYT option is less expensive to residents than continuing the *status quo*, and under refined assumptions, some of the bag PAYT options are also less expensive than continuing the *status quo*. The conclusion from the feasibility study remains.

Figure 1 below shows the monthly, first year, and tenth year cost to residents and the City under several assumptions:³

- A: SERA’s original feasibility model from December 2015
- B: Refining the bag costs and usage figures to lower values for the PAYT bag option
- C: Adding on WZ’s most aggressive waste reduction percentages
- D: Adding on WZ’s “guaranteed” waste reduction percentage (including Option B)
- E: Option D plus reducing cart costs to \$48.55 from \$55.

Figure 1 shows that the PAYT bag options are generally 1-4% more expensive than the cart-based options for the 10 year period. The percentage differences for the costs in year 6 and for the 10 years of household costs are larger because at approximately 5 years, the cost of carts are paid off. Although not specified in the figure, the cart options are about 4% less expensive than the *status quo*.

In each option, the 10 year cost to residents is lowest under the cart-based PAYT option.

Finally, the costs are presented for full cost recovery. The status quo cost recovery in Asheville is roughly 50% of the full cost of service. As a policy issue, the City may opt to recover these service costs fully through user fees (bag fees or cart rates), or recover part of the cost through taxes or fixed / generator fees and the remainder through bag or cart fees. There are pros and cons to charging rates as full cost or two-part rates (discussed in multiple SERA publications). If cost recovery continues around 50%, the bag or cart fees will be roughly half the fees presented in the feasibility study (in simplified terms). The feasibility study presented the pattern of rate levels under a variety of cost recovery options – for both bag and cart-based PAYT options.

Regardless of whether the City elects full cost recovery through trash fees, or opts for two-part rates with part of the costs transferred from tax-sourced general fund, the money comes from Asheville households; there is no other real source of funds. The city can opt for full cost recovery OR partial cost recovery from *either* a bag or a cart-based system and craft rates the Council feels are appealing, affordable, or politic – and “phase in” changes if that is more workable. However, ultimately, if costs are higher (as they are under the bag option), citizens pay more.

³ As mentioned within the text below, Option C is more aggressive than we believe realistic; option B also may include lower bag set-out rates than may be realized. Each of these refinements would tend to increase the costs associated with the PAYT bag option.

Figure 1: Summary of PAYT Options Costs using Original and Updated Assumptions for Asheville

Asheville PAYT Scenarios	Status Quo	Cart-based PAYT	Bag-based PAYT	Percent
A) Original Feasibility Study				
Recycling Rate	21.0%	29.0%	31.5%	Difference Bag vs. Cart
Waste Reduction	21.0%	34.0%	36.5%	
Yr 1 Cost per HH per Month under FULL cost recovery	\$18.82	\$18.75	\$20.00	
HH Total Cost over 10 years	\$2,258	\$2,214	\$2,400	8%
City-wide cost, Year 1	\$7,001,040	\$6,975,000	\$7,440,000	7%
City-wide cost Year 6	\$7,001,040	\$6,751,800	\$7,440,000	10%
B) Reduced cost and usage of bags (1 bag, 0.275/bag incl inventory)				
Recycling Rate		29.0%	31.5%	
Waste Reduction		34.0%	36.5%	
Yr 1 Cost per HH per Month under FULL cost recovery		\$18.75	\$19.17	
HH Total Cost over 10 years		\$2,214	\$2,300	4%
City-wide cost, Year 1		\$6,975,000	\$7,130,078	2%
City-wide cost Year 6		\$6,751,800	\$7,130,078	6%
C) Most Aggressive Waste Reduction rate for bag option (includes Option B)				
Recycling Rate		29.0%	39.0%	
Waste Reduction		34.0%	44.0%	
Yr 1 Cost per HH per Month under FULL cost recovery		\$18.75	\$18.66	
HH Total Cost over 10 years		\$2,214	\$2,239	1%
City-wide cost, Year 1		\$6,975,000	\$6,940,358	0%
City-wide cost Year 6		\$6,751,800	\$6,940,358	3%
D) WZ "Guaranteed" waste reduction rate for bag option (Includes Option B)				
Recycling Rate		29.0%	32.5%	
Waste Reduction		34.0%	37.5%	
Yr 1 Cost per HH per Month under FULL cost recovery		\$18.75	\$19.12	
HH Total Cost over 10 years		\$2,214	\$2,294	4%
City-wide cost, Year 1		\$6,975,000	\$7,111,067	2%
City-wide cost Year 6		\$6,751,800	\$7,111,067	5%
E) Reduced Cost for Carts (\$48.55 vs. \$55) (includes Option D)				
Recycling Rate		29.0%	32.5%	
Waste Reduction		34.0%	37.5%	
Yr 1 Cost per HH per Month under FULL cost recovery		\$18.64	\$19.12	
HH Total Cost over 10 years		\$2,201	\$2,294	4%
City-wide cost, Year 1		\$6,934,700	\$7,111,067	3%
City-wide cost Year 6		\$6,711,500	\$7,111,067	6%
For all Options, cart option costs reduce by 60 cents after ~5 years after carts paid off.				

2. SENSITIVITY ANALYSIS / DEFENSE OF SERA CONCLUSIONS

WasteZero makes several key criticisms of the data used to analyze the bag option.

Criticisms of Bag Costs and Bag Usage

Conclusion from sensitivity analysis: Under all the included container cost and usage assumption ranges, the Cart-based program remains cheaper than the bag program. Over a 5 year period, carts will cost households \$55 and be paid off, while bags will cost households \$59 at that point, and the costs will continue indefinitely into the future. Over a 10 year period, carts cost \$55 and bags will cost households \$119. Over a 15 year period carts will cost \$55 and bag will cost the household \$178. If bag inventory costs⁴ are added, these bag cost totals are \$71, \$142, and \$213, respectively. The bag outlays pay for the containers in 4-6 years (See Figure 4 and 5).

WZ argues that SERA's assumptions of the cost to purchase bags from manufacturers was overstated. It also argues that bag usage data is inflated. Because these two pieces of information are jointly used to derive the core conclusion of the study – the difference in cost between a bag vs. cart-based PAYT option – these two elements are best addressed jointly.

Part 1 - Manufacturer Prices for Bags: SERA looked online for logoed PAYT bag prices, and found figures from a few manufacturers. WasteZero does not publish bag prices online, and calls to the few communities that would share data initially indicated prices above thirty cents each. When SERA staff called the customer service staff at WasteZero, we were provided a cost estimate of \$0.35 per bag. In their critique, WasteZero argues this cost is too high.

In response, SERA conducted additional data searches for manufactured bag prices (at least 1.5 mils). The most useful site was the Commonwealth of Massachusetts (MassDEP), which performed a service for their state communities, asking for guaranteed quotes for PAYT bags from multiple manufacturers. These are presumably lower-end prices, given they are statewide bids. The bids are provided in Figure 2, which provides the purchase prices for bags, in minimum purchases of 250,000 bags per order, and at least 10 bags per box.⁵ At the bottom of Figure 2, we present a range for the “average” price per bag, given a ratio of between 25% and 33% smaller bags, and 67-75% larger bags.

⁴ By “inventory” costs, we mean additional costs for inventory/distribution and billing costs for the bags, discussed in Figure 2 and elsewhere.

⁵ This is the lowest option presented on the website. The bid page indicates “Call for current prices – they may be lower”. We called all the approved firms except WasteZero and each indicated the prices posted were also the current prices.

Figure 2: Cost of PAYT Bags Purchased from Multiple Manufacturers – Lower end (MA Statewide Bids Valid thru 6/2016)

	Boxes & Bags	Box/Bags Twist Tie	Mansfield Handle tie	Mansfield Twist tie	TBC - Wave	TBC Standard	WasteZero
8 gal							\$0.131
10 gal							\$0.141
15 gal	\$0.124	\$0.127	\$0.154	\$0.140	\$0.122	\$0.129	\$0.156
30 gal	\$0.220	\$0.238	\$0.263	\$0.234	\$0.209	\$0.214	\$0.253
Added for distrib & billing	\$0.03-\$0.05	\$0.03-\$0.05					\$0.05-\$0.06
Wtd Avg (33%/67% for 15/30g)	\$0.188	\$0.201	\$0.227	\$0.203	\$0.180	\$0.186	\$0.221
Wtd Avg (25%/75% for 15/30g)	\$0.196	\$0.210	\$0.236	\$0.210	\$0.187	\$0.193	\$0.229
Wtd avg using 10/30 gal at 25%/75%.							\$0.225

From these figures, it appears a competitive price for a “bag” (assuming a mix of smaller and larger bags) is between a low of \$0.186 (from Tags Bags Containers, Inc.) to \$0.236 from Mansfield Paper Company, Inc. (their “handle tie” design). This range of numbers will be used again in Figure 4.

Part 2 - Bag Usage by Households: The number of bags set out weekly by an average household was also questioned. The SERA analysis for this feasibility study used data from two sources:

- Asheville survey responses: Under a can program, about 50% of households would use 32 gallons of service, 36% on 64 gallons, and 14% would use 96 gallons of service.⁶ This is an average of 52.5 gallons of service weekly, or 1.75 bags of 30 gallons each week or 1.64 32-gallon bags. If a mix of small and larger bags are used, the total bags per week is larger.
- Estimates of household trash tons divided by bag weights: Dividing the estimated trash tonnage per month by an average weight per bag of 20 pounds led to an estimate of 4.5 bags per month, or, in round numbers, about 1 bag per week.

For the feasibility analysis, SERA selected a number in this range (1.5 bags per week), with somewhat more weight placed on the survey responses.

It has been somewhat difficult to find more than a handful of communities with WasteZero programs that have data. Some were included in the original SERA report’s appendix. We have gathered information from a few communities – which may or may not be representative of the 850 total “partner” communities Waste Zero supplies with bags, or representative of bag-based PAYT programs nationally. They are, however, some of the communities Waste Zero commonly uses as examples in its outreach. These are summarized in Figure 3.

⁶ Based on Asheville Survey conducted in 2015. The responses were not statistically random, but achieved 1,100 responses.

Figure 3: Bags per Household from a Small Sample of WasteZero Communities

		Worcester MA (15&30)	Decatur GA (8&15&33)	Gloucester MA (15&36)	Shrewsbury MA (15&33)	Tiverton RI (15&30)	Malden MA (8&15&33 &53)
Households in bag program		52,000	6,000	13,000	13,424	6,000	19,050
Very small bags sold/yr	8 gal		120,698				17,000
Small bags sold / yr	15 gal	1,350,000	273,478	32,000	288,230	N.A.	355,500
Large bags sold / yr	30-36 gal	1,660,000	118,979	480,000	364,977	N.A.	419,250
	53 gal						27,100
Average bags / week / household		1.11	1.64	0.76	0.94	N.A.	0.83
Percent Large vs. small bags	8 gal	0%	24%	0%	0%		2%
Percent Large vs. small bags	15 gal	45%	53%	6%	44%	35%	43%
Percent Large vs. small bags	30-36 gal	55%	23%	94%	56%	65%	51%
	53 gal						3%

SERA’s initial analysis developed an estimate between 1 bag and 1.7 bags per household (the December report used 1.5 bags/hh/week); the data from this small sample of well-cited WZ communities is between 0.8 and 1.6 bags per household. The average number of bags from these communities is about 1.06 bags⁷ per household.

Relative Cost for Carts vs. Bags Containerization:

Figures 4 and 5 below confirm SERA’s conclusion that cart-based containerization is less expensive for Asheville residents – and that the conclusion holds across a wide range of input assumptions.

Figure 4 shows the number of months of bag purchases by households that will have paid for a trash cart – the “payback” period (in months) for the carts. The numbers going across the table are the average number of bags set out per household; the numbers going down the table are the average cost per bag purchased from manufacturers. The yellow cells show ranges of assumptions indicated from the Massachusetts bag cost research. Figures for number of bags per household range from 0.8 to 1.6. This is similar to SERA’s range of 1-1.7. The cells that are colored red represent combinations with a payback of 5 years or less for carts.

Even narrowing the range of bags per household by deleting the largest and smallest value (narrowing the range from 0.9-1.1 bags per household per week) from the small sample of WZ communities, Figure 4 shows that:

- The range of months for payback is 48 months to 71 months, or 4 years to less than 6 years.
- After that period, households continue to pay for bags (every week forever), but they have already paid off the carts (which last 15 plus years, and are warranted for 10).

Figure 5 shows that, under an assumption of \$0.23 average bag cost from the manufacturer, and just 1 bag per week per household:

- at the end of 10 years, households have paid twice as much for bags as for cans (\$119 vs. \$55), and
- at the end of 15 years, they would have paid \$178 for bags, and just \$55 for cans.

⁷ The population-weighted average is about 1.02 bags per household.

Bag costs and payments continue uninterrupted over time; the modeling work develops a 5-year payment period for carts, after which payments for the container ceases.

Note that this uses a very conservative assumption of \$55 for cans. An updated cost estimate identifies \$48.55 per can as a potentially-more accurate number; however, we continue to use \$55 for this part of the analysis to be conservative. This updated derivation of cart costs is provided in Figure 6.

Figure 4: PAYT Bag vs. Cart Payback Analysis: Months after which Bag Costs are Higher than Cart Costs (at \$55 for carts)

PAYT Bag vs. Cart Payback Analysis											
Months to pay back purchase of Cans with Mfg Cost of Bags											Cells highlighted if payback is less than 5 years, or # months=>
Situations under which it is better to buy cans											Approximate cost of a typical trash can plus deliver, maint=>
<== Bags/HH/Week ==>											
Cost vs. # Bags	0.7	0.8	0.9	1	1.1	1.2	1.3	1.4	1.5	1.6	1.7
\$0.12	151	132	118	106	96	88	81	76	71	66	62
\$0.13	140	122	109	98	89	81	75	70	65	61	57
\$0.14	130	113	101	91	82	76	70	65	60	57	53
\$0.15	121	106	94	85	77	71	65	60	56	53	50
\$0.16	113	99	88	79	72	66	61	57	53	50	47
\$0.17	107	93	83	75	68	62	57	53	50	47	44
\$0.18	101	88	78	71	64	59	54	50	47	44	42
\$0.19	96	84	74	67	61	56	51	48	45	42	39
\$0.20	91	79	71	64	58	53	49	45	42	40	37
\$0.21	86	76	67	60	55	50	47	43	40	38	36
\$0.22	82	72	64	58	52	48	44	41	38	36	34
\$0.23	79	69	61	55	50	46	42	39	37	35	32
\$0.24	76	66	59	53	48	44	41	38	35	33	31
\$0.25	73	64	56	51	46	42	39	36	34	32	30
\$0.26	70	61	54	49	44	41	38	35	33	31	29
\$0.27	67	59	52	47	43	39	36	34	31	29	28
\$0.28	65	57	50	45	41	38	35	32	30	28	27
\$0.29	63	55	49	44	40	37	34	31	29	27	26
\$0.30	60	53	47	42	38	35	33	30	28	26	25
\$0.31	59	51	46	41	37	34	32	29	27	26	24
\$0.32	57	50	44	40	36	33	31	28	26	25	23
\$0.33	55	48	43	38	35	32	30	27	26	24	23
\$0.34	53	47	42	37	34	31	29	27	25	23	22
\$0.35	52	45	40	36	33	30	28	26	24	23	21
\$0.36	50	44	39	35	32	29	27	25	24	22	21
\$0.37	49	43	38	34	31	29	26	25	23	21	20
\$0.38	48	42	37	33	30	28	26	24	22	21	20
\$0.39	47	41	36	33	30	27	25	23	22	20	19
\$0.40	45	40	35	32	29	26	24	23	21	20	19

Figure 5: Containerization Cost Comparison assuming 1 bag per week paying \$0.23/bag to manufacturer

After ... years	Total cost/hh paid toward bags	... Including Bag Inventory Control	Total cost/hh paid toward carts
0.5	\$5.93	\$7.10	\$5.93
1.0	\$11.87	\$14.19	\$11.87
1.5	\$17.80	\$21.29	\$17.80
2.0	\$23.74	\$28.38	\$23.74
2.5	\$29.67	\$35.48	\$29.67
3.0	\$35.60	\$42.57	\$35.60
3.5	\$41.54	\$49.67	\$41.54
4.0	\$47.47	\$56.76	\$47.47
4.5	\$53.41	\$63.86	\$53.41
5.0	\$59.34	\$70.95	\$55.00
5.5	\$65.27	\$78.05	\$55.00
6.0	\$71.21	\$85.14	\$55.00
6.5	\$77.14	\$92.24	\$55.00
7.0	\$83.08	\$99.33	\$55.00
7.5	\$89.01	\$106.43	\$55.00
8.0	\$94.94	\$113.52	\$55.00
8.5	\$100.88	\$120.62	\$55.00
9.0	\$106.81	\$127.71	\$55.00
9.5	\$112.75	\$134.81	\$55.00
10.0	\$118.68	\$141.90	\$55.00
10.5	\$124.61	\$149.00	\$55.00
11.0	\$130.55	\$156.09	\$55.00
11.5	\$136.48	\$163.19	\$55.00
12.0	\$142.42	\$170.28	\$55.00
12.5	\$148.35	\$177.38	\$55.00
13.0	\$154.28	\$184.47	\$55.00
13.5	\$160.22	\$191.57	\$55.00
14.0	\$166.15	\$198.66	\$55.00
14.5	\$172.09	\$205.76	\$55.00
15.0	\$178.02	\$212.85	\$55.00

Figure 6: Refined Containers Cost Computations for Asheville

	30-32 gal	64 gal	90-96 gal	Total Cost
Percent subscribed	39%	37%	24%	
# carts Needed with 3% extra inventory	12,090	11,470	Repurposed from existing carts	
# Lids needed (optional, for repurposing existing carts)			7,440	
Cost per Cart	\$45.00	\$50.00	\$50.00	\$1,117,550
Cost per lid, installed			\$15.00	\$111,600
Assembly & Delivery Cost	\$8.00	\$8.00		\$188,480
Incremental Maintenance Cost	\$0.00	\$0.00	\$0.00	
Total Cost	\$640,770	\$665,260	\$111,600	\$1,417,630
Financing purchase cost at 3%, 5 years, monthly				\$87,305
Total Cost				\$1,504,935
Total cost / HH				\$48.55

Staffing issues:

According to the Massachusetts DEP website and interviews with communities, bag companies charge extra for inventory control and management (if that option is selected). Without this fee, it is up to the City to staff for these duties. Bag companies (including WZ⁸) charge about \$0.03-\$0.06 cents per bag for automatic restocking and billing / supply costs per bag (see Figure 2).⁹ In Asheville, this would total about \$58K-106K per year, even under a relatively conservative assumptions of 0.9-1.1 bags per household per week. These are new costs, and are presented in Figure 7.

Figure 7: Bag System Inventory Control Costs in Asheville Per Year

	0.9 bags / hh	1.1 bags/hh
at 4 cents/bag	\$58,032	\$70,928
at 6 cents/bag	\$87,048	\$106,392

The city already pays for cart maintenance (it already owns carts, and would continue to own carts under either cart or bag options). This is a cost Asheville would continue to pay under either a PAYT bag or cart option¹⁰, and is not new to the cart-based PAYT program.

Additional, or incremental costs for the cart-based PAYT may include some additional cost for cart size exchanges related to multiple size containers. For a community the size of Asheville, these costs are not expected to exceed 0.5 staff, and are usually concentrated in the first year, after which exchanges are minimal.¹¹ The costs in Figure 7 exceed this 0.5 FTE by a factor of 2-4. These extra costs for a cart-based system last perhaps a year.

Adding bag inventory costs into the payback analysis (Figure 5 incorporates a \$0.045 fee per bag) shows a 4 year payback compared to cart costs including these fees, and total payments are \$142 (after 10

⁸ WZ's estimate for MassDEP is 4-5 cents per bag (in addition to base bag cost).

⁹ It is not clear if postage is included in this fee or whether there is an additional fee; we assume it is inclusive.

¹⁰ These costs are usually estimated about \$0.25 per cart per month or less. Cart warranties are commonly about 10 years.

¹¹ In fact, most communities charge for cart exchanges after the first "free" one.

years) and \$213 (after 15 years) compared to \$55 for the cart-based program. The conclusion remains substantially the same even extra costs of one-half to one-quarter of this value (0.5 FTE) is included for the cart-based program for the first year.

Conclusion - The math is very straightforward. Given a wide range of assumptions, the cart-based PAYT containers cost Asheville households less than the bag-based PAYT system. Under bag-friendly assumptions, after 10 years, households will pay \$119 for bags and \$55 for cans; after 15 years, the totals are \$178 vs. \$55.

What can mitigate this cost difference? Recycling tonnage differences for bag vs. can PAYT options – including performance and avoided tipping fees can be a source of relative savings. We next examine those assumptions.

Recycling Tonnage and Waste Reduction differences.

SERA has published large-sample statistical analyses of the recycling impacts due to the PAYT incentive, reporting that the average impact on recycling programs is an increase of 6 percentage points, and an average of 6 percentage points of waste diversion.¹² SERA notes in the feasibility report that it has been unable to substantiate a statistically-significant difference between the recycling impacts of bag- vs. cart-based PAYT programs using large-sample regression analysis. However, SERA notes that results that there are apparent (but not statistically-significant) differences in recycling rates that could possibly attribute one to three percentage points additional impact to a bag-based program. To create a scenario that was more favorable to bag-based programs in the feasibility analysis, we assigned more 2.5 percentage points more diversion to the bag scenario.

SERA notes that Asheville staff and the citizen group is enthusiastic about the potential of a PAYT program, and that the community's recycling rate, without a PAYT program, is fairly robust. For this reason, SERA's assumptions in the feasibility analysis SERA assumed an increase of recycling of 8 percentage points for the can-based program – a robust 33% greater than published estimates. As mentioned, we assigned an additional 2.5 percentage points for the bag program, despite the lack of large-scale statistical research defending this addition. Thus, in the feasibility analysis SERA assumed the following:

- Recycling in Asheville under PAYT would increase from 21% (current) to 29% and 31.5% under cart- and bag-based PAYT, respectively (an addition of 8-10.5 percentage points).
- This is a 38-50% increase in the recycling rate due to PAYT, without further change in the underlying recycling program.
- SERA's feasibility study also incorporates an assumption of 4 percentage points of waste reduction¹³ beyond the recycling impact.
- SERA's feasibility study also incorporated an assumption of 1 percentage point of reduction from new yard waste diversion from the PAYT incentive.

¹² Note that these published studies also attribute substantial increases in organics diversion, but Asheville does not have an organics program, so these effects were not included in the program's potential impact in the feasibility analysis.

¹³ Examples of this effect include donating rather than disposing, repairing rather than replacing/discarding, and buying carefully.

- This leads to a total of 13-15.5 percentage points of new diversion, or given 79% of Asheville’s waste is trash to start, this is a reduction of 16.5%-19.6% waste reduction from the trash can.
- The combined waste diversion impact (recycling and waste reduction) modeled in SERA’s feasibility analysis for Asheville is **34% (carts) to 36.5% (bags)**.

WZ argues that in their critique that these increases are too low, and that the total waste reductions resulting after the new WZ PAYT program in Asheville should be “...an average of 44% or perhaps over 50%” (page 1).¹⁴ The examples WZ cites for Asheville’s council include Decatur, GA (42% recycling rate) and Shrewsbury, MA (44%). In fact, strong-performing PAYT examples are not limited to bag programs; for example, the most widely recognized, well-documented, high-performing communities like Seattle WA, San Francisco CA, Portland OR, San Jose CA, and others are each cart-based PAYT programs with residential recycling rates exceeding 45%. These levels of recycling programs exist under PAYT strategies. PAYT is in place and is a driver for the vast majority of strongest-performing communities in the US.

SERA presents data from several case studies of WZ communities it was able to obtain (more data are not published by WZ). These are presented in Figure 8. The resulting recycling rates range from 28-44%, and the average for this small sample of communities is 36-37%. Those communities with “before-program” recycling rates in the 20% range increased to current recycling rates about 32-37%. Communities with populations larger than 15,000 average 35.5%.

Figure 8: Recycling Rates for a Small Sample of WasteZero Communities

	Worcester MA (15&30)	Decatur GA (8&15&33)	Gloucester MA (15&36)	Shrewsbury MA (15&33)	Tiverton RI (15&30)	Malden MA (8&15&33 &53)	Dartmouth MA (15&30g)	Natick MA (15&33g)
Households in bag program	52,000	6,000	13,000	13,424	6,000	19,050	9,805	13,406
RECYCLING								
More Recent recycling rate	43%	44%	32%	32%	34%	28%	36%	37%
Recycling Rate 1 year after program	38%	22%	31%	33%	40%	25%	26%	
Beginning recycling rate	2%	11%	23%	22%	20%	11%	13%	23%
Tons of recycling	9465	2700	3012	3086	1979	4500	2431	4174
Calculated recycling tons/hh/yr	0.182	0.450	0.232	0.230	0.330	0.236	0.248	0.311

Figure 8 also provides the recycling tonnage for each community, and the number of households. This allows us to compute associated recycling tons per household per year for each community. Using data from this small sample of WZ communities, we can compute the recycling rates that would arise in Asheville, by:

- Using the recycling tons per year per household from each community and multiplying times 31,000 households in Asheville;
- Dividing this figure by Asheville’s “generation tons”, or denominator consisting of trash plus recycling plus organics (40,448 tons) provides an estimate of the associated recycling rate.

¹⁴ It is a little unclear in the critique whether the interpretation is that Asheville’s final waste reduction would be 44-50% or the additional waste reduction beyond their existing values should be 44-50%. The language used is “the city achieving waste reduction outcomes greater than our company average of 44% and perhaps over 50%...” (page 1). They seem to mean that the City’s waste reduction would be a final total of 44-50%. Given the case studies listed, we assume they mean this would be the recycling rate, but they may be including source reduction – no distinction is made in the WZ literature / analysis. The lower interpretation, we think, would result in a computation of 1.44 or 1.5 times 21% which would be 30%-31.5%. Given the criticism of SERA’s numbers, we assume WZ means the higher interpretation.

The resulting recycling rates, extrapolating from these TPY values, are included at the bottom of Figure 9.

Figure 9: Recycling Rates that would Result in Asheville from Extrapolating other WZ Community Recycling Tons Per Year (TPY) Figures.

	Worcester MA (15&30)	Decatur GA (8&15&33)	Gloucester MA (15&36)	Shrewsbury MA (15&33)	Tiverton RI (15&30)	Malden MA (8&15&33 &53)	Dartmouth MA (15&30g)	Natick MA (15&33g)
Households in bag program	52,000	6,000	13,000	13,424	6,000	19,050	9,805	13,406
RECYCLING								
More Recent recycling rate	43%	44%	32%	32%	34%	28%	36%	37%
Recycling Rate 1 year after program	38%	22%	31%	33%	40%	25%	26%	
Beginning recycling rate	2%	11%	23%	22%	20%	11%	13%	23%
Tons of recycling	9465	2700	3012	3086	1979	4500	2431	4174
Calculated recycling tons/hh/yr	0.182	0.450	0.232	0.230	0.330	0.236	0.248	0.311
Recy TPY multiplied times Asheville's HHs ==> recycling TPY of...	5643	13950	7182	7126	10225	7323	7686	9652
Given current generation in Asheville of 40,448 TPY, calculates recycling rate of....	14%	34%	18%	18%	25%	18%	19%	24%

Note that none of these recycling rates exceeds 34%. The resulting range for the recycling rate would be 14% - 34%, with an average of about 21% (18% weighted by population, and 16% for those with households over 15,000). Certainly, there is a case to be made that generation rates differ between communities, and between communities in NC vs. those in the northeast. However, it introduces some question as to the recycling rates that would be derived from the bag-based PAYT program.

Although Asheville could well be a very green community, SERA is uncomfortable assuming a 44% recycling, or even 44% waste reduction rate as a result of the introduction of the PAYT program.

The Payback under Aggressive WZ Waste Reduction Assumptions

However, suppose we do assume 44% resulting waste reduction rate as purported under WZ's assumptions. That would add 7.5 percentage points of additional recycling over the figures in SERA's feasibility model (44% minus SERA's modeled reduction of 36.5% for bag scenario). To model the additional savings for the *bag option compared to the cart-based option*, we would look at the difference between 44% waste reduction (WZ assumption) and SERA's cart-based model estimating 34% reduction. This transfers about 4,040 incremental tons from trash to recycling (10% of 40,448 tons of generation) for the bag options compared to the cart option.¹⁵ The difference in tipping fees would be about \$189,900 per year. Per household per month (dividing this figure by 31,000 households and 12 months) this total is \$0.51. Revising Figure 4 to account for this difference, we see that the point at which the cans are paid for through bag prices (payback) is between 6.5 and 7 years, and after 10 years, the costs for the bag option are \$81 (and \$121 after 15 years) compared to the cart-based model's cost of \$55 (see Figure 10).¹⁶ **The aggressive assumption for extra recycling does not make up the**

¹⁵ Normally it would matter whether the increase is in recycling or in source reduction, but Asheville has instructed us that the cost of recycling will not change with more recycling. Therefore, the avoided cost is the full landfill tipping fee for recycling or waste reduction. Normally the avoided cost for recycling would be the difference between the landfill tip fee and the recycling tip fee or program cost effects.

¹⁶ Note that this computation includes zero cost change for the recycling program, despite the substantial increase in tons.

difference in container costs, and the cart-based program is still cheaper for Asheville’s residents.
 Note that there no barrier to higher recycling rates from a cart-based option.

Figure 10: Payback Analysis – Cost of Containers Plus Aggressive WZ-Suggested Tonnage Savings from Bag Option (revised from Figure 4)

After ... years	Total cost/hh paid toward bags	... Including Bag Inventory Control	Total cost/hh paid toward carts	Reducing cost for bag option by 51 cents/month to account for highest recycling assumption...
0.5	\$5.93	\$7.10	\$5.93	\$4.04
1.0	\$11.87	\$14.19	\$11.87	\$8.07
1.5	\$17.80	\$21.29	\$17.80	\$12.11
2.0	\$23.74	\$28.38	\$23.74	\$16.14
2.5	\$29.67	\$35.48	\$29.67	\$20.18
3.0	\$35.60	\$42.57	\$35.60	\$24.21
3.5	\$41.54	\$49.67	\$41.54	\$28.25
4.0	\$47.47	\$56.76	\$47.47	\$32.28
4.5	\$53.41	\$63.86	\$53.41	\$36.32
5.0	\$59.34	\$70.95	\$55.00	\$40.35
5.5	\$65.27	\$78.05	\$55.00	\$44.39
6.0	\$71.21	\$85.14	\$55.00	\$48.42
6.5	\$77.14	\$92.24	\$55.00	\$52.46
7.0	\$83.08	\$99.33	\$55.00	\$56.49
7.5	\$89.01	\$106.43	\$55.00	\$60.53
8.0	\$94.94	\$113.52	\$55.00	\$64.56
8.5	\$100.88	\$120.62	\$55.00	\$68.60
9.0	\$106.81	\$127.71	\$55.00	\$72.63
9.5	\$112.75	\$134.81	\$55.00	\$76.67
10.0	\$118.68	\$141.90	\$55.00	\$80.70
10.5	\$124.61	\$149.00	\$55.00	\$84.74
11.0	\$130.55	\$156.09	\$55.00	\$88.77
11.5	\$136.48	\$163.19	\$55.00	\$92.80
12.0	\$142.42	\$170.28	\$55.00	\$96.84
12.5	\$148.35	\$177.38	\$55.00	\$100.88
13.0	\$154.28	\$184.47	\$55.00	\$104.91
13.5	\$160.22	\$191.57	\$55.00	\$108.95
14.0	\$166.15	\$198.66	\$55.00	\$112.98
14.5	\$172.09	\$205.76	\$55.00	\$117.02
15.0	\$178.02	\$212.85	\$55.00	\$121.05

Rates and Revenues – Households Pay

WZ argues that SERA’s feasibility study includes a flawed revenue model. This is a very naïve comment. The feasibility study examined the full cost of service under two new PAYT options compared to the existing model. Whether the customers pay for the bag program -- or the cart-based program -- partly through bag OR can rates, AND partly through taxes (or other fixed fees), the customers still pay. Money and revenue is not magically created.

If 50% of the cost remains subsidized through the general fund (as is approximately the case now), the bag and can rates would be reduced by (roughly) half.¹⁷ Alternatively, the City may opt for full cost recovery through user fees (one- or two-part user fees, as either program can have a “base fee”) – or any level in-between. This is a policy choice to be made by the City.

However, no matter how customers are charged, the cost of the PAYT cart-based program is less than the cost of the PAYT bag-based program, and is less expensive than the City maintaining its current non-PAYT based system.

Conclusions

The conclusion from the feasibility study remains. The PAYT cart-based program is less expensive to residents than the PAYT bag-based program; furthermore, the cart option is less expensive than the City maintaining its current non-PAYT based system,¹⁸ and several options for the bag-based program are also cheaper than the *status quo* costs.

Figure 11 below shows the monthly, first year, and tenth year cost to residents and the City under several assumptions:

- A: The original feasibility model from December 2015
- B: Refining the bag costs and usage figures to lower values for the PAYT bag option
- C: Adding on WZ’s most aggressive waste reduction percentages
- D: Adding on WZ’s “guaranteed” waste reduction percentage (including Option B)
- E: Option D plus reducing cart costs to \$48.55 from \$55.

In each option, the 10 year cost to residents is lowest under the cart-based PAYT option.

As mentioned within the text above, Option C is more aggressive than may be realistic; Option B also may include lower bag set-out rates than may be realized. Each of these refinements would tend to increase the costs associated with the PAYT bag option.

¹⁷ There are some shifts in can (and less so, bag) subscriptions rates expected, and thus, some shifts in cart rates charged, but this is not central to the point being made.

¹⁸ The remaining WZ critiques do not affect any of the conclusions. One comment suggested SERA did not address cart suppliers or tips. Cart manufacturers are well-known. Some of the largest are Toter, Otto, Shaefer, Cascadia and Rehrig Pacific. Communities recommend injection molded carts, arguing they have longer lifetimes with gripper arms. Warranties on carts are often 10 years, and cart maintenance contracts are usually about 25 cents per cart per month. Haulers commonly have drivers keep wheels in their trucks and have them fix wheel problems while on route.

Figure 11: Updated Assumptions of Costs for PAYT Options for Asheville

Asheville PAYT Scenarios	Status Quo	Cart-based PAYT	Bag-based PAYT	Percent
A) Original Feasibility Study				
Recycling Rate	21.0%	29.0%	31.5%	Difference Bag vs. Cart
Waste Reduction	21.0%	34.0%	36.5%	
Yr 1 Cost per HH per Month under FULL cost recovery	\$18.82	\$18.75	\$20.00	
HH Total Cost over 10 years	\$2,258	\$2,214	\$2,400	8%
City-wide cost, Year 1	\$7,001,040	\$6,975,000	\$7,440,000	7%
City-wide cost Year 6	\$7,001,040	\$6,751,800	\$7,440,000	10%
B) Reduced cost and usage of bags (1 bag, 0.275/bag incl inventory)				
Recycling Rate		29.0%	31.5%	
Waste Reduction		34.0%	36.5%	
Yr 1 Cost per HH per Month under FULL cost recovery		\$18.75	\$19.17	
HH Total Cost over 10 years		\$2,214	\$2,300	4%
City-wide cost, Year 1		\$6,975,000	\$7,130,078	2%
City-wide cost Year 6		\$6,751,800	\$7,130,078	6%
C) Most Aggressive Waste Reduction rate for bag option (includes Option B)				
Recycling Rate		29.0%	39.0%	
Waste Reduction		34.0%	44.0%	
Yr 1 Cost per HH per Month under FULL cost recovery		\$18.75	\$18.66	
HH Total Cost over 10 years		\$2,214	\$2,239	1%
City-wide cost, Year 1		\$6,975,000	\$6,940,358	0%
City-wide cost Year 6		\$6,751,800	\$6,940,358	3%
D) WZ "Guaranteed" waste reduction rate for bag option (Includes Option B)				
Recycling Rate		29.0%	32.5%	
Waste Reduction		34.0%	37.5%	
Yr 1 Cost per HH per Month under FULL cost recovery		\$18.75	\$19.12	
HH Total Cost over 10 years		\$2,214	\$2,294	4%
City-wide cost, Year 1		\$6,975,000	\$7,111,067	2%
City-wide cost Year 6		\$6,751,800	\$7,111,067	5%
E) Reduced Cost for Carts (\$48.55 vs. \$55) (includes Option D)				
Recycling Rate		29.0%	32.5%	
Waste Reduction		34.0%	37.5%	
Yr 1 Cost per HH per Month under FULL cost recovery		\$18.64	\$19.12	
HH Total Cost over 10 years		\$2,201	\$2,294	4%
City-wide cost, Year 1		\$6,934,700	\$7,111,067	3%
City-wide cost Year 6		\$6,711,500	\$7,111,067	6%
For all Options, cart option costs reduce by 60 cents after ~5 years after carts paid off.				

Under each option, the PAYT cart-based model is less expensive for Asheville residents.

Waste Zero’s guarantee of a “minimum waste reduction of 37.5%” (presented in Option D) represents an added expense to Asheville’s residents compared to the cart-based option. If Asheville is going to be an outstanding community with high diversion rates (like, potentially, Decatur, GA’s PAYT bag program), there is nothing to say it may not be an outstanding community like Seattle, under a can-based PAYT program, with the advantages of:

- lower cost,
- less operational complexity (assuring logoed bags are used in the cans), and
- easier explanation to citizens.