FINAL

MIXED WASTE PROCESSING ECONOMIC AND POLICY STUDY

SUBMITTED TO:

American Forest & Paper Association

September 2015

BURNS & McDONNELL

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September 10, 2015

Mr. Brian Hawkinson
Executive Director, Recovered Fiber
American Forest & Paper Association
1101 K Street, N.W., Suite 700
Washington, D.C. 20005

Re: **Final Report – Mixed Waste Processing Economic and Policy Study**

Dear Mr. Hawkinson:

Burns & McDonnell is pleased to submit the Final Report for the Mixed Waste Processing Economic and Policy Study for the American Forest & Paper Association (AF&PA).

We appreciate the opportunity to work with AF&PA. If you have any questions concerning this report, please contact Mr. Scott Pasternak at (512) 872-7141.

Sincerely,

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PROJECT OVERVIEW

As the composition of the waste stream continues to change and communities' interest in diversion evolves, seeking viable options to increase recycling rates is a challenge. Some communities have sought to better understand whether mixed waste processing could assist local governments with meeting their recycling goals. Recognizing that multiple technical, economic, and environmental questions exist concerning the feasibility of mixed waste processing, the American Forest and Paper Association (AF&PA) retained the services of Burns & McDonnell (BMcD) to develop an economic and policy study (Study) for its members regarding mixed waste processing. The focus of the Study was economic feasibility and did not address other factors, such as environmental impacts. The report is organized as follows:

- Executive Summary
- Section 1 – Economic Evaluation
- Section 2 – Industry Insights
- Appendix

BACKGROUND INFORMATION

Prior to addressing the key findings of the Study, BMcD thought it would be meaningful to provide some background to provide a common understanding and perspective regarding the findings. The focus of this Study was recovering material from residential sources for the purpose of recycling. However, there is a discussion of the impact of waste-to-energy, and specifically refuse derived fuel, later in this Executive Summary. This Study evaluates mixed waste processing relative to a baseline of single-stream processing. For the purposes of this Study, the two terms are defined as follows:

> **Recycling** is defined as the series of activities by which material that has reached the end of its current use is processed into material utilized in the production of new products.
>
> - National Recycling Coalition

- **Single-Stream:** Commingled recyclables are collected separately from refuse. The commingled recyclables are then processed at a single-stream material recovery facility (MRF) to separate them into the individual commodities for sale.
- **Mixed Waste:** All materials, recyclables and refuse, are collected together and processed at a mixed waste processing facility, sometimes referred to as a "dirty MRF," to recover recyclable commodities and other divertible materials.

Section 1 provides more detail regarding the assumptions for waste composition and market price for the commodities. However, Figure 1 provides a relative measure of prevalence in the waste stream and market price for the three main categories of recyclable material generated from homes and businesses: paper, plastic and metals.

Paper in the residential waste stream includes primarily newsprint, office paper, magazines/catalogs, corrugated cardboard, boxboard, mixed paper, and other lower grades of paper. Index prices for recovered paper from single-stream MRFs range from $60 to $145 per ton[1], and paper typically makes up 25-35 percent of the residential waste stream.

The highest value plastics typically recovered from the waste stream are PET (#1), natural HDPE (#2), and colored HDPE (#2). Depending on local markets, #3-#7 plastics, plastic film, rigid plastics, and other plastic materials may be recovered for sale, but are generally sold for a much lower market price than the PET and HDPE materials. The index price for recovered PET containers is $360 per ton, while HPDE ranges from $580 per ton for colored and $920 per ton for natural.[2] Plastics as a whole typically make up 10-20 percent of the residential waste stream.

Metals in the residential waste stream are typically aluminum and steel food and beverage containers, but may also include other household ferrous and non-ferrous metals. Scrap metal is not included in this category. Metals represent a smaller portion of the residential waste stream (typically less than 5 percent), but the index price for aluminum containers is $1,600 per ton and $120 per ton for steel containers.[2]

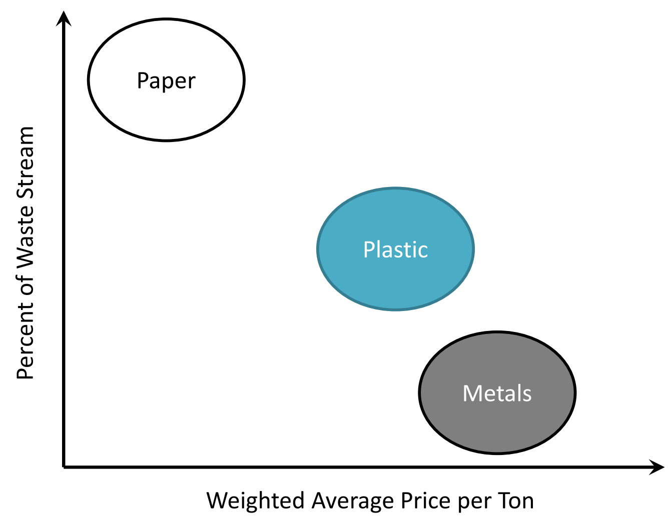

Figure 1 - Recyclable Waste Stream and Price

ECONOMIC COMPARISON

The scenarios that could be evaluated for this Study are practically unlimited. For its evaluation, BMcD developed a representative scenario that represents a large municipality where the local government has control over where the residential waste stream is hauled. The representative scenario was based on a community of 250,000 households that generates 325,000 tons of household waste and recyclables, excluding bulky items and large brush. The community does not need to be an individual city, but could represent a larger metropolitan area or several cities in the same geographic region. For example, using the average of 2.63 persons per household,[3] the 250,000 households represent a population of approximately 650,000. According to 2013 population estimates from the U.S. Census,[4] there are 83 metropolitan statistical areas (MSAs) with a population over 650,000. These 83 MSAs represent approximately 63 percent of the United States population. Therefore the number of households for this study applies to a number of communities in the United States. A mixed waste facility that can process 325,000 tons per year would be a very large facility that maximizes the processing capacity of today's mixed waste processing systems. For larger communities, more than one mixed waste facility may be needed to accommodate higher tonnage quantities.

[1] Index prices for paper based on December 2014 values from the Pulp and Paper Index (PPI) for the Southwest region.

[2] Index prices for plastic based on December 2014 values from RecyclingMarkets.net for Houston (Southcentral) region.

[3] Based on information from the U.S. Census Bureau: http://quickfacts.census.gov/qfd/states/00000.html

[4] Population estimates: http://www.census.gov/popest/data/metro/totals/2013/index.html

Since the Study compares mixed waste processing to single-stream, Scenario 1 for the analysis is a mature single-stream program with moderate recycling rates. The scenarios evaluated in the Study are as follows:

- **Scenario 1** – A community with only a single-stream recycling program. The refuse container is collected by a second collection vehicle and hauled to a disposal location.
- **Scenario 2** – A community with a single-stream program that adds a mixed waste processing facility to increase diversion. There are two collection vehicles that pass by each home: one for single-stream recyclables and one for mixed waste.
- **Scenario 3** – A community that goes with a "one bin" system where are materials collected at the curb are taken to a mixed waste facility. There is no single-stream collection or processing for Scenario 3.
- **Scenario 4** – Similar to Scenario 3 except that the mixed waste facility produces a refuse-derived fuel (RDF) from non-recyclable paper and plastics.

Table 1 summarizes the results based on the baseline assumptions. Below Table 1, BMcD list several variables and discusses how a change in each impacts the analysis.

Table 1 – Economic Evaluation Comparison

	Scenario 1 Single-Stream Only	Scenario 2 Single-Stream Plus Mixed Waste	Scenario 3 Mixed Waste Processing Only	Scenario 4 Mixed Waste with RDF
Annual Tons				
Single-Stream Tons	81,250	81,250	0	0
Mixed Waste Tons	0	243,750	325,000	325,000
Refuse Tons	243,750	0	0	0
Total Facility Capital Cost [1]	$24,347,000	$61,111,000	$45,181,000	$51,131,000
Annual Expenses				
Amortized Facility Capital	$2,271,000	$5,774,000	$4,356,000	$5,126,000
Facility Operating Costs	$4,039,000	$10,894,000	$7,903,000	$9,370,000
Disposal/Secondary Processing				
Refuse Disposal	$8,531,000	$0	$0	$0
Residual Disposal	$635,000	$6,473,000	$7,660,000	$5,992,000
Composting	$0	$1,485,000	$1,869,000	$1,143,000
Curbside Collection	$20,359,000	$20,359,000	$14,908,000	$14,908,000
Revenue from Sale of Recyclables	($6,680,000)	($15,113,000)	($11,741,000)	($11,741,000)
Revenue from Sale of RDF	$0	$0	$0	($2,038,000)
Total Annual Expenses	$29,155,000	$29,872,000	$24,955,000	$22,760,000 [2]
Recyclable Tons Recovered [3]	67,146	106,931	61,356	61,356
Total Expense per Recovered Ton	$434.20	$279.36	$406.73	$370.95

1. Excludes capital for collection (vehicles and carts).
2. While there may be a theoretical economic incentive to create RDF from some of the non-recyclable mixed waste, the market for selling that material in the United States is very limited. Therefore the operator would be risking several million dollars in up-front capital to create a product in which the market has shown little interest.
3. Tons recovered for recycling. Does not include tons that may be diverted for composting, landfill daily cover, or other landfill diversion.

Table 2 provides addition detail for the revenue from the sale of recyclables. There are some materials, such as glass bottles, that are recycled, but do not generate revenue in most markets. Other materials, such as compostable organics, are diverted from disposal through composting, but do not generate revenue as compost feedstock. Scenario 2 shows the incremental revenue and tonnage from the mixed waste processing facility that would be operated at the same time as a single-stream MRF. The total revenue and tonnage for Scenario 2 includes the revenue and tonnage from Scenario 1 (total revenue of $15.1 million and total recycled tons of approximately 107,000 tons). The revenue and tonnage for recycling in Scenario 4 equals the amounts shown for Scenario 3.

Table 2 – Revenue for Recovered Commodities

	Annual Revenue			Percent of Revenue		
Material	**Scenario 1**	**Scenario 2** [1]	**Scenario 3**	**Scenario 1**	**Scenario 2** [1]	**Scenario 3**
Paper	$3,457,396	$1,132,453	$1,933,639	52%	13%	16%
Recyclable Plastics	$1,921,792	$2,847,313	$4,113,767	29%	34%	35%
Other Plastics	$0	$0	$0	0%	0%	0%
Metal	$1,300,568	$4,453,037	$5,693,643	19%	53%	48%
Glass	$0	$0	$0	0%	0%	0%
Other Materials	$0	$0	$0	0%	0%	0%
Total	$6,679,756	$8,432,804	$11,741,049	100%	100%	100%
Recovered Tons	67,146	39,785	61,356			
Revenue per Recovered Ton	$99.48	$211.96	$191.36			

1. Revenue and Percent of Revenue for Scenario 2 is the incremental increase over Scenario 1. The total for Scenario 2 equals the incremental revenue plus the revenue from Scenario 1.

Looking only at the bottom-line results from Table 1, single-stream appears to be the most expensive option based on total expense per recovered ton. However, there is more to consider when evaluating these options than just the bottom-line number:

- Scenario 1 has the highest cost per recovered ton, using the baseline assumptions, but it offers the second highest recovery of recyclables and the lowest facility capital cost.
- Scenario 2 offers the lowest cost per recovered ton but requires 2.5 times the facility capital as just a single-stream program. For communities willing to invest in the additional upfront capital, Scenario 2 may yield the highest recycling rates.
- In order to achieve a similar level of recovered tons as Scenario 1, the mixed waste facility for Scenario 3 must process 325,000 tons compared to the 81,250 tons from Scenario 1. Processing this additional mixed waste material results in a facility capital cost that is 85 percent greater than the single-stream scenario.
- Assuming the mixed waste facility can successfully market RDF, the additional capital and operating cost of producing RDF is more than offset by the revenue generated from the sale of the RDF (Scenario 4).

The economic analysis does not take into account any economic or financial incentives that a single-stream MRF or mixed waste facility owner/operator could pursue. Appendix D includes a discussion of some available financial incentives that may be available and their potential to impact the economic analysis.

IMPACT OF WASTE-TO-ENERGY

This section provides a general discussion of waste-to-energy as it relates to mixed waste processing facilities and its potential financial impact.

Anaerobic Digestion

Section 1.7 assumes that food waste and non-recyclable paper is composted for $20 per ton, which takes into account the revenue received from the sale of the compost. While composting cost may vary, $20 per ton is typical based on BMcD's experience with other composting operations.

As an alternative to composting, the mixed waste processor could also divert the organic materials to an anaerobic digestion facility. Anaerobic digestion is the biological conversion of organic matter, in an oxygen-free environment, with a gaseous byproduct that includes methane and carbon dioxide. The gas is typically 40 to 70 percent methane, depending on the feedstock mixture. That methane can be used to generate electricity or can be utilized in direct use applications (e.g., boilers).

While anaerobic digestion may provide a waste-to-energy option for mixed waste facilities, the cost of anaerobic digestion is typically $50 to $70 per ton, which is significantly higher than the $20 per ton cost of the aerobic windrow composting that was assumed for the financial analysis.

Waste-to-Energy for Residuals

Another waste-to-energy option for mixed waste processing facilities is to send some of the residuals to a separate waste-to-energy facility (e.g., incineration, gasification). The facility could be located adjacent to the mixed waste facility to minimize transportation or could be located further away at a separate location.

Some of the soil paper that was assumed to be composted in Scenario 2 and 3, and the non-recyclable plastics and other non-recyclable items were disposed. The mixed waste facility has the option of diverting the soiled paper and non-recyclable plastics to waste-to-energy facility. However, BMcD assumed a $35 per ton disposal fee and a $20 composting fee in the analysis. Based on BMcD's experience with other waste-to-energy facilities, either operating facilities or facilities evaluated as part of planning process, the tipping fee at waste-to-energy will typically be greater than the $35 disposal fee assumed in the economic analysis. Therefore, while waste-to-energy will allow for greater diversion (not greater recycling), it will be a more expensive option than landfilling in most cases.

Refuse-Derived Fuel

AF&PA also asked BMcD to evaluate the potential impact on mixed waste if the operator would use material from the mixed waste facility, primarily consisting of non-recyclable paper and plastic, to create a refuse-derived fuel (RDF) pellet to supplement coal at utility-scale power plants or in commercial/industrial applications. For the purposes of estimating revenue for RDF, the analysis focuses on RDF as a coal or natural gas substitute.

The RDF material would consist of some mixed waste material that would otherwise be composted and some material that would otherwise be disposed. The net result was that up to 73,000 tons could potentially be diverted for RDF (approximately 60 percent paper and 40 percent plastic). Table 4 summarizes the revenue from the RDF based on a range of discounts relative to coal. The analysis could also be based on a discount relative to natural gas. Based on an average cost of $30.50 per ton to process the mixed waste into RDF, the cost for processing the RDF exceeds the revenue from selling it to power plants. However, compared to the assumed disposal cost of $35 per ton or compost fee of $20 per ton, there may still be a financial incentive for the mixed waste operator to pursue creating RDF.

Table 4 – RDF Revenue

Discount Relative to Coal	Annual Revenue	Revenue per Ton	Cost per Ton	Net Revenue (Expense) per Ton
15%	$2,165,180	$29.51	$30.50	($0.99)
20%	$2,037,816	$27.78	$30.50	($2.72)
25%	$1,910,453	$26.04	$30.50	($4.46)
30%	$1,783,089	$24.30	$30.50	($6.20)
40%	$1,528,362	$20.83	$30.50	($9.67)
50%	$1,273,635	$17.36	$30.50	($13.14)

Economic analysis aside, BMcD has experience evaluating potential RDF projects for clients across the U.S. One of the biggest issues faced by companies looking to produce RDF at a large scale is being able to actually sell the product. Power plant operators have been unwilling to purchase the RDF and co-fire the material with coal or other fuels such as natural gas. One large manufacturer of pelletizing equipment that BMcD spoke with as part of this Study said they are not aware of any company selling pelletized RDF to coal-fired power plants in the United States. They were aware of some examples in Europe.

Therefore, while there may be a theoretical economic incentive to create RDF from some of the non-recyclable mixed waste, the market for selling that material in the United States is very limited. Therefore, the operator would be risking several million dollars in up-front capital to create a product in which the market has shown little interest.

There While there are examples of using fluff RDF[5] to fuel boilers in commercial or institutional applications, creating the fluff RDF still requires a similar level of capital and operating costs and requires the additional capital cost of dedicated boilers.

In addition, the viability of RDF as a fuel substitute for power plants will vary as the market price for coal or natural gas changes. As the price for natural gas or coal increases, the more financially attractive alternate fuel sources, such as RDF, become. Conversely, when there is a decline in the price for coal or natural gas, power plant operators have less of a financial incentive to seek out alternate fuel sources.

ECONOMIC SENSITIVITY

The following presents sensitivity analysis for four variables: recycling rate, size of community, recycling market prices, and disposal costs. BMcD also included a discussion of how refuse-derived fuel may impact the analysis.

[5] Fluff RDF is a processed, but less dense form of RDF compared to pelletized RDF.

Recycling Rate

Scenario 1 includes a baseline assumption that 650 pounds (gross) of single-stream recyclables per household per year are collected from residential households. Factoring out contamination and residual, this results in approximately 540 pounds per household per year recycled. Based on BMcD's experience, as well as benchmark data discussed in Section 1, the 540 pounds per household is reasonable for a mid-range, mature single-stream program. Many successful single-stream programs are able to exceed this recycling rate, while some programs struggle to reach this point for a variety of reasons. Figure 2 shows how changing this assumption impacts the end results for the single-stream only scenario (the dark blue column represents the baseline assumption as reflected in Table 1).

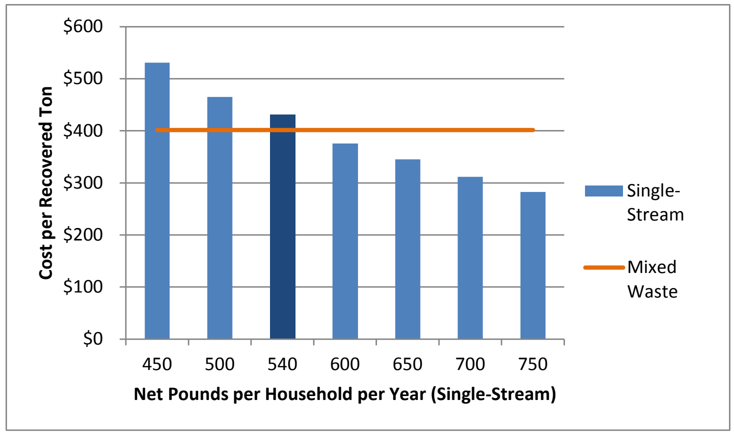

Figure 2 - Impact of Recycling Rate

As the household recycling rate increases, the cost per recovered ton decreases, and single-stream recycling becomes more financially competitive even for larger communities. Achieving 571 net pounds per household per year results in the cost per recovered ton for Scenario 1 (single-stream) and Scenario 3 (mixed waste) being equal. As a basis for comparison, some successful single-stream programs across the United States have been able to achieve household recycling rates of greater than 700 net pounds per household per year. Despite the recovered cost per ton being lower for Scenario 1 beyond 571 pounds per household per year, the total cost for Scenario 1 still exceeds the total cost for Scenario 3.

Size of Community

The analysis presented in Table 1 is based on community of 250,000 households. As discussed, this may represent an individual city, or multiple cities in close geographic proximity. Varying the number of households, and thus tons generated, has an impact on the analysis. Generally speaking, the smaller the community, the more economically feasible single-stream recycling will be compared to one-bin mixed waste processing. However, a larger community with more than 325,000 tons per year would likely need to divert tonnage over that amount to a disposal location or building a second facility. Building a second facility could result in the cost per recovered ton increasing over the baseline. One reason is that the expense per recovered ton for single-stream will fall below that of mixed waste processing. A second reason is that a smaller community may be less able to make the additional capital investment required for a one-bin mixed waste processing facility. The exact break-even point is based on the geography of the area (i.e., hauling distance) and the other variables discussed in this study. However, assuming the facility depends solely on material from the residential waste stream, BMcD would expect mixed waste processing to less economically feasible than single-stream for communities with less than 150,000 households (with the other assumptions from Table 1 constant). That threshold number of households decreases with the acceptance of material from other sources. In other words if the number of households is lower, say 75,000 for example, the facility would need to accept material from other sources such as commercial and institutional customers.

Recycling Market

Market prices for recovered commodities can vary by area of the country. The revenue for the economic evaluation was based on December 2014 index data for the southwest United States since this geographic area represents somewhat of an average as compared to the other regions. On the west coast, market prices are oftentimes higher than in other parts of the country. However, disposal costs are also generally higher as well, contributing to higher costs for disposal of residuals. Like all commodities, the market prices also fluctuate based on a variety of market forces. Furthermore, the individual commodities may fluctuate differently from one another. The change in market prices can have an impact on the financial comparison of single-stream and mixed waste. To illustrate this point, BMcD looked at the market low and high over the last five years (Jan 2010 – Dec 2014). The low was January 2010 and the high was May 2012 based on a blended average of market values and composition of the recycling stream. Table 3 shows that in January 2010, when markets were at their lowest in the last five years, difference between the cost per recovered ton for single-stream and mixed waste narrowed. When markets were at their highest in the last five years, difference between the cost per recovered ton for single-stream and mixed waste widened. In conclusion, the economic performance of the three scenarios is impacted by the fluctuation in market prices and each scenario is impacted differently based on the quantity of each of the commodities recovered.

Table 3 – Impact of Changing Market Prices

		Cost per Recovered Ton	
Month	Market Status	Single-Stream	Mixed Waste
Dec 2014	Baseline	$434	$401
Jan 2010	Low	$427	$421
May 2011	High	$376	$323

Disposal Cost

Compared to the other variables discussed, disposal cost has the least amount of impact on the economic comparison. Wide variations in disposal price impact all scenarios, but the difference between the scenarios changes only incrementally. As disposal cost decreases, the cost per recovered ton for single-stream also decreases relative to mixed waste. The opposite occurs when disposal cost increases. With all other baseline variables constant, the break-even point (such that single-stream and mixed waste cost per ton is equal) is approximately $10-$12 per ton, which is lower than virtually all disposal rates in the United States.

KEY FINDINGS OF ECONOMIC ANALYSIS

The key findings from this Study are supported by the economic analysis found in Section 1 and the interviews with AF&PA members and mixed waste processors, summarized below and discussed in Section 2. The economic analysis in Section 1 takes into account not only the cost of constructing and operating the recycling facilities, but also the curbside collection costs and disposal costs of residual materials. Figure 3 provides an overview of the how single-stream compares to mixed waste based on the size of community and strength of recycling program.

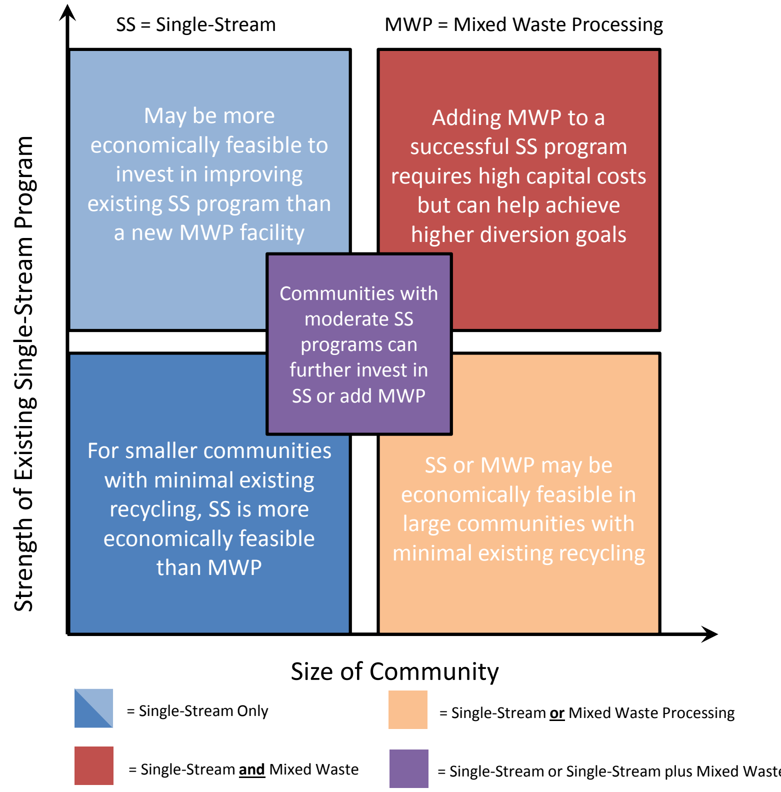

Figure 3 - Overview of Single-Stream vs. Mixed Waste

Every Situation is Unique

While this Study sought to evaluate the feasibility of mixed waste facilities, the reality is each situation is unique. The economic analysis provides a baseline and discusses the impact of changing several of the assumptions. While the key variables (recycling rate, size of community, recycling market, and disposal cost) under the Economic Comparison were discussed separately, it is important to understand that all four, plus others, may act together to impact the feasibility. For example, in a smaller community, with high recycling rates, low disposal rates, and in a period of low market rates, single-stream will easily be more economically feasible than mixed waste. Conversely, in a very large community with low recycling rates, high disposal costs, and in a period of high market rates, mixed waste processing may be the more economically viable option, assuming the high upfront costs and low recovery of paper are acceptable to the community.

Mixed Waste Facilities Focused More on Recovering Metal and Plastic and Less on Paper

Mixed waste facilities, including those with paired with a waste to energy solution, recover a lower percentage of clean, recyclable paper than single-stream MRFs. Modern single-stream MRFs can divert 90 to 95 percent of the paper collected through single-stream programs and this material is typically sold at $60 to $145 per ton. Single-stream MRFs derive a significant portion of their commodity revenue from recovered paper. Therefore there is a strong incentive to maximize recovery of paper.

The paper in mixed waste facilities commonly becomes soiled from food waste and other constituents of the waste stream. While the processing equipment is capable of physically separating higher percentages of paper, there is not a strong market for soiled paper. Therefore, the ability for mixed waste facilities to recover clean, recyclable paper is reduced compared to single-stream MRFs. The economic model of a mixed waste processing system is based on recovering high percentages of plastic and metal from the waste stream and is less dependent on the recovery of paper. Therefore, the mixed waste facility operator is willing to sell paper at lower grades or to divert more paper to other processes such as composting in order to avoid disposal. Utilizing soiled paper in waste to energy, whether directly or through RDF, reduces expenses relative to disposal, but still generates less revenue than the sale of recycled paper. Further, recycled paper can be made into new products and continue to be recovered and recycled. Whereas paper utilized in a waste to energy process is removed from the material use cycle. If mixed waste facilities were to become more commonplace, their decreased dependence on recovering paper has the potential to greatly impact the AF&PA members that rely on purchasing recovered paper.

The highest and best use of paper is recycling it into other products. Single-stream material recovery facilities are able to recover a higher percentage of paper due to contamination issues associated with mixed waste processing facilities.

Mixed Waste Processing Requires Greater Capital Investment

Single-stream MRFs require less capital and operating costs than mixed waste processing facilities. When collection costs and refuse disposal (not MRF residual) are taken into consideration, the comparison between the two depends on a number of variables, including but not limited to: size of community, success of existing recycling program, market prices, and disposal prices. While in some cases a one-bin system may seem an "easier" solution for some communities, the high capital cost and lower overall recycling rates may make single-stream a more feasible option.

Adding Mixed Waste Processing to Single-Stream Programs is an Option to Increase Recycling

For a medium to large community that has moderately successful single-stream program, but that is looking to increase their recycling rates the community could seek to increase recycling via a more robust single-stream program or by adding mixed waste processing. To enhance the single-stream program, the community can invest more heavily in public education and develop incentives to increase recycling (e.g., pay-as-you-throw rates). Alternatively, the community can evaluate adding a mixed waste processing facility to supplement the single-stream program. Moving forward with the additional facility for processing mixed waste will require a significant capital investment. Therefore, a community could benefit economically by making an incremental investment in single-stream, as compared to a larger investment in mixed waste processing.

Investing in a strong public education program and developing incentives for residents to recycle is an investment that benefits a single-stream program, but also a community that chooses to introduce mixed waste processing. From the residents' viewpoint, the mixed waste cart should still be viewed as waste and residents should maximize the material diverted to the single-stream cart. Encouraging this behavior will help ensure higher levels of clean paper can be recovered from single-stream while still allowing additional recovery from the mixed waste cart. If residents see both carts as recycling carts, then the program effectively becomes a one-bin mixed waste program where recovery rates of clean paper will decline.

INDUSTRY RESEARCH

As part of the Study, BMcD interviewed both AF&PA members and mixed waste facility owners and operators. The purpose of these interviews was to gain a better understanding of the market for materials, especially paper, from mixed waste facilities and the recovery rates from mixed waste facilities.

AF&PA Member Interviews

As part of the part of the Study, BMcD reached out to a number of AF&PA members to gain their perspective on mixed waste processing. These members primarily operate paper mills and/or MRFs. Our questions to the members were related to their experience purchasing and processing paper from mixed waste processing facilities. The following b summarizes the key information we received from these interviews. Since there are several viewpoints represented, not all bulleted items agree with one another.

- Several of the paper mills have not purchased any paper materials from mixed waste facilities and do not plan on purchasing from them going forward. The reasons were primarily related to the cleanliness of the material (i.e., high levels of contamination and odor).
- Other paper mills have purchased some quantities from mixed waste facilities, but the material purchased met their specifications and they would not purchase unless the specifications are met.
- Paper mills are not willing to purchase a lower grade product for a discount relative to the going market rate of recovered paper.
- Members that send materials to China are concerned with loads with higher levels of contamination being rejected due to the "Green Fence" policy.
- Several members questioned whether there was any domestic market for paper recovered from mixed waste facilities
- One member felt there were four options for paper recovered from mixed waste facilities: (1) waste-to-energy, (2) landfill, (3) export market, or (4) compost.
- Contamination is huge issue for many paper mills because they produce packaging for food other consumer products.
- Several members acknowledged mixed waste is a bigger issue for the paper industry since plastics and metals can more easily be washed.

Mixed Waste Facility Owner and Operator Interviews

Based on our industry experience and input from AF&PA, Burns & McDonnell developed case studies from communities that have implemented or have considered implementing (and ultimately decided against) mixed waste processing. The case study communities are summarized in Table 5.

Table 5: Mixed Waste Processing Case Studies

Facility/Location	Status
Western Placer Materials Recovery Facility (WPMRF): Lincoln, California	Facility began operations in 1995; recently completed update in 2007
Central Processing Facility (CPF): Medina, Ohio	Facility operated from 1993 through January 2015
Infinitus Renewable Energy Park (IREP): Montgomery, Alabama	Facility began operations in April 2014
Advanced Recycling Center (ARC): Indianapolis, Indiana	Facility under contract with Covanta; construction anticipated for 2016
City of Dallas, Texas	Studied mixed waste processing in 2014 and decided not to implement
Escambia County/Emerald Coast Utilities Authority, Florida	Qualifications for mixed waste processing facility were due December 18, 2014
Prince George's County, Maryland	Request for qualifications for waste processing and alternative energy project are due March 12, 2015

Appendix B contains a summary matrix of the information gathered for each of the case study facilities. Table 6 shows the recovery rate for traditional recyclables for several of the mixed waste facilities in Table 5, plus the SMaRT facility in Sunnyvale, CA.

Table 6: Mixed Waste Processing Recovery Rates

Facility/Location	Annual Incoming Tons	Traditional Recyclables Recovery Rate[1]	Source
WPMRF: Lincoln, CA	210,000	11.3-13.0%	2013 and 2014 Actuals
CPF: Medina, OH	120,000	6.2% [2]	2012 Actuals
ARC: Indianapolis, IN	260,000	18 - 22% [3]	Contract Target
SMaRT Station: Sunnyvale, CA	190,000	5.0% [4]	2013-2014 Actuals

1. Traditional Recyclables: aluminum, ferrous, cardboard, newspaper, mixed paper, glass, HDPE, PET, and mixed plastics.
2. Only 52% of waste stream was processed at CPF, recovery rate calculated from only waste processed.
3. The contract between the City of Indianapolis and Covanta allows Covanta to determine which materials are deemed recoverable.
4. The SMaRT Station facility diverts a significant amount of recyclables through its curbside program.

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APPENDICES

1.0 ECONOMIC ANALYSIS

Section 1 summarizes the economic analysis that BMcD performed to evaluate mixed waste processing relative to single-stream processing. Four scenarios were evaluated in this economic analysis:

- **Scenario 1** – A community with only a single-stream recycling program. The refuse container is collected by a second collection vehicle and hauled to a disposal location.
- **Scenario 2** – A community with a single-stream program that adds a mixed waste processing facility to increase diversion. There are two collection vehicles that pass by each home: one for single-stream recyclables and one for mixed waste.
- **Scenario 3 –** A community that goes with a "one bin" system where are materials collected at the curb are taken to a mixed waste facility. There is no single-stream collection or processing for Scenario 3.
- **Scenario 4 –** Similar to Scenario 3 except that the mixed waste facility produces a refuse-derived fuel (RDF) from non-recyclable paper and plastics.

For Scenario 2, BMcD assumed that mixed waste processing would be added in a community that already has single-stream processing. Therefore, the costs discussed in this section for Scenario 2 include cost for two separate facilities.

The economic analysis does not take into account any economic or financial incentives that a single-stream MRF or mixed waste facility owner/operator could pursue. Appendix D includes a discussion of some available financial incentives that may be available and their potential to impact the economic analysis.

1.1 Representative Community

The scenarios that could be evaluated for this Study are practically unlimited. For its evaluation, BMcD developed a representative scenario that symbolizes a large municipality where the local government has control over where the residential waste stream is hauled. The model scenario was based on a community of 250,000 households that generates 325,000 tons of household waste and recyclables, excluding bulky items and large brush. The community does not need to be an individual city, but could represent a larger metropolitan area or several cities in the same geographic region. For example, using the average of 2.63

persons per household,[1] the 250,000 households represent a population of approximately 650,000. According to 2013 population estimates from the U.S. Census,[2] there are 83 metropolitan statistical areas (MSAs) with a population over 650,000. These 83 MSAs represent approximately 63 percent of the United States population. Therefore the number of households for this study applies to a number of communities in the United States. A mixed waste facility that can process 325,000 tons per year would be a very large facility that maximizes the processing capacity of today's mixed waste processing systems. For larger communities, more than one mixed waste facility may be needed to accommodate higher tonnage quantities.

For Scenario 1, the baseline assumption for the amount of material picked up for single-stream processing is 650 pounds per household per month, including any contamination and MRF residual. Once MRF contamination and residual are removed, the net quantity is approximately 540 pounds per household per year.

As a point of reference, the North Central Texas Council of Governments *Regional Recycling Rate Update* [3] from 2011 included recycling rates for close to 70 communities in the Dallas-Fort Worth region. Of the 20 communities with roll-cart recycling service that responded to the survey, five of them had recycling rates greater than 540 pounds per household per year. The average for those five communities was 610 pounds per household, with the highest being 632 pounds per household.

1.2 Summary Economic Analysis

Table 1-1 provides a summary of the economic evaluation. Sections 1.3 through 1.8 provide additional detail for each line of Table 1-1. Scenario 4 is based on Scenario 3, except with the additional capability for producing the RDF. Therefore Sections 1.3 and 1.8 focus on Scenarios 1 through 3, with an additional description in each section of how Scenario 3 would be impacted by the additional of RDF (which is Scenario 4). Section 1.9 provides general discussion of waste-to-energy options for mixed waste processing facilities and additional detail for the RDF analysis..

The values shown in Table 1-1 are rounded to the nearest thousand dollars and therefore vary from subsequent tables based on the rounding difference.

[1] Based on information from the U.S. Census Bureau: http://quickfacts.census.gov/qfd/states/00000.html

[2] Population estimates: http://www.census.gov/popest/data/metro/totals/2013/index.html

[3] http://www.nctcog.org/envir/SEELT/reduction/NCTCOG_Regional_Recycling_Update_FINAL_083111.pdf

The analysis presented in this section is based on a baseline set of assumptions with regard to recycling rate, disposal costs, market prices, and community size. Section 1.10 provides the results of sensitivity analysis on these variables.

Table 1-1: Economic Evaluation Summary

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
	Single-Stream Only	Single-Stream Plus Mixed Waste	Mixed Waste Processing Only	Mixed Waste with RDF
Annual Tons				
Single-Stream Tons	81,250	81,250	0	0
Mixed Waste Tons	0	243,750	325,000	325,000
Refuse Tons	243,750	0	0	0
Total Facility Capital Cost [1]	$24,347,000	$61,111,000	$45,181,000	$51,131,000
Annual Expenses				
Amortized Facility Capital	$2,271,000	$5,774,000	$4,356,000	$5,126,000
Facility Operating Costs	$4,039,000	$10,894,000	$7,903,000	$9,370,000
Disposal/Secondary Processing				
Refuse Disposal	$8,531,000	$0	$0	$0
Residual Disposal	$635,000	$6,473,000	$7,660,000	$5,992,000
Composting	$0	$1,485,000	$1,869,000	$1,143,000
Curbside Collection	$20,359,000	$20,359,000	$14,908,000	$14,908,000
Revenue from Recyclables	($6,680,000)	($15,113,000)	($11,741,000)	($11,741,000)
Revenue from Sale of RDF	$0	$0	$0	($2,038,000)
Total Annual Expenses	$29,155,000	$29,872,000	$24,955,000	$22,760,000[2]
Recyclable Tons Recovered [3]	67,146	106,931	61,356	61,356
Total Expense per Recovered Ton	**$434.20**	**$279.36**	**$406.73**	**$370.95**

1. Excludes capital for collection (vehicles and carts).
2. While there may be a theoretical economic incentive to create RDF from some of the non-recyclable mixed waste, the market for selling that material in the United States is very limited. Therefore the operator would be risking several million dollars in up-front capital to create a product in which the market has shown little interest.
3. Tons recovered for recycling. Does not include tons that may be diverted for composting, landfill daily cover, or other landfill diversion.

Looking only at the bottom-line results from Table 1-1, single-stream appears to be the most expensive option based on total expense per recovered ton. However, there is more to consider when evaluating these options than just the bottom-line number:

- Scenario 1 has the highest cost per recovered ton, using the baseline assumptions, but it offers the second highest recovery of recyclables and the lowest facility capital cost.
- Scenario 2 offers the lowest cost per recovered ton but requires 2.5 times the facility capital as just a single-stream program. For communities willing to invest in the additional upfront capital, Scenario 2 may yield the highest recycling rates.
- In order to achieve a similar level of recovered tons as Scenario 1, the mixed waste facility for Scenario 3 must process 325,000 tons compared to the 81,250 tons from Scenario 1. Processing this additional mixed waste material results in a facility capital cost that is 85 percent greater than the single-stream scenario.
- Assuming the mixed waste facility can successfully market RDF, the additional capital and operating cost of producing RDF is more than offset by the revenue generated from the sale of the RDF (Scenario 4).

1.3 Capital Costs

While Scenario 2 represents both a single-stream and mixed waste facility, Table 1-2 provides information regarding the individual facilities for each of the scenarios. The single-stream MRF applies to both Scenario 1 and Scenario 2, the "smaller" of the two mixed waste facilities applies to Scenario 2 and the "larger" of the two mixed waste facilities applies to Scenario 3. Compared to Scenario 3, Scenario 4 would require a larger processing building (approximately 15,000 to 25,000 additional square feet) to accommodate the equipment to manage, produce and ship the RDF.

Table 1-2: Facility Processing Capacity and Size

Facility Type	Single-Stream MRF	Smaller Mixed Waste Facility	Larger Mixed Waste Facility
Scenario	Scenario 1 and 2	Scenario 2 Only	Scenario 3 Only
Tons per Year	81,250	243,750	325,000
MRF shifts	2	2	2
MRF Processing Hrs/Week/Shift	40	40	40
Total Processing Hours per Year	4,160	4,160	4,160
Tons per Hour	20	59	78
Design Capacity	25	59	78
Processing Building Size (sq ft)	80,000	125,000	150,000
Land Size (Acres)	9	14	17

Based on the facilities described in Table 1-2, Table 1-3 includes the total capital cost estimate for each scenario, excluding the capital cost for collection vehicles and carts (see Section 1.5). Table 1-3 includes a total capital amount and the annual amortized capital.

Table 1-3: Facility Capital Cost

	Scenario 1	Scenario 2	Scenario 3
	Single-Stream Only	Single-Stream Plus Mixed Waste	Mixed Waste Processing Only
Building and Site			
Land	$675,000	$1,725,000	$1,275,000
Site Work	$720,000	$1,840,000	$1,360,000
Scale House	$600,000	$1,200,000	$600,000
MRF Building	$8,560,000	$20,560,000	$13,950,000
Other [1]	$3,458,000	$8,260,000	$5,568,500
Subtotal	$14,013,000	$33,585,000	$22,753,500
Contingency (not Land)	$1,333,800	$3,186,000	$2,147,850
Total Building and Site	$15,346,800	$36,771,000	$24,901,350
Processing Equipment	$8,600,000	$23,055,000	$19,110,000
Rolling Stock	$400,000	$1,285,000	$1,170,000
Total Facility Capital	$24,346,800	$61,111,000	$45,181,350
Annual Amortized Capital [2]	**$2,270,893**	**$5,773,863**	**$4,356,442**

1. Other includes Design/Engineering, Surveying, Permitting, Construction Management, Owners Advisory and Admin Costs
2. Building and site costs were amortized over 20 years, processing equipment over 12 years, and rolling stock over 7 years.

For Scenario 4, the incremental capital cost (over the capital required for Scenario 3) for adding the capability of producing RDF includes additional building footprint to house the RDF processing equipment plus pelletizers, a magnetic sorter, an eddy current sorter, dedicate loader, shredder, and conveyers. The total capital cost is estimated to be $5 to $7 million, with the amortized cost being approximately $660,000 to $880,000 per year.

1.4 Facility Operating Costs

Table 1-4 includes the facility operating costs for each scenario. The operating costs for collection are included in Section 1.5. The cost for disposing or processing residuals is included in Section 1.7, as are the transportation costs associated with hauling residuals.

Based on experience with other RDF facilities, BMcD estimates the operating cost of the RDF portion of Scenario 4 to be $15 to $25 per incoming ton. Based on an average of $20 per ton, the additional annual operating expense for creating RDF is estimated to be approximately $1.5 million.

Table 1-4: Facility Operating Cost

	Scenario 1 Single-Stream Only	Scenario 2 Single-Stream Plus Mixed Waste	Scenario 3 Mixed Waste Processing Only
Labor	$2,718,560	$7,633,600	$5,468,320
Building & Site Maint.	$98,800	$236,000	$159,100
Equipment Maint.			
Processing	$258,000	$691,650	$573,300
Rolling Stock	$64,000	$205,600	$187,200
Utilities	$149,760	$358,384	$275,808
Rolling Stock Fuel	$77,400	$207,495	$171,990
Consumables/Services	$27,186	$76,336	$54,683
Baling Wire	$220,435	$335,289	$179,546
Insurance	$40,778	$114,504	$82,025
Contingency/Reserve	$365,492	$985,886	$715,197
Admin	$18,275	$49,294	$35,760
Total O&M	**$4,038,685**	**$10,894,038**	**$7,902,929**

1.5 Collection Costs

To evaluate the total costs of each scenario, BMcD evaluated the cost for collecting material from residences. BMcD assumed that collection would be cart-based using automated side-load collection vehicles.

Table 1-5 shows the total and annual cost for the purchase of carts. For both Scenario 1 and 2, each household would have at least one refuse and one recycling cart. BMcD assumed that 10 percent of households would have a second refuse cart. While residents in Scenario 3 are on a “one bin” system, not all residents will be able to fit their weekly waste into one physical cart. Therefore, BMcD assumed that 50 percent of households would have an additional cart. The total cart count for Scenarios 1 and 2 is 525,000 carts (combined refuse and recycling) and 375,000 carts for Scenario 3 (all mixed waste).

The annual collection costs for Scenario 4 are the same as Scenario 3.

Table 1-5: Collection Carts

	Scenario 1	Scenario 2	Scenario 3
	Single-Stream Only	Single-Stream Plus Mixed Waste	Mixed Waste Processing Only
Recycling Carts per Household	1.0	1.0	0.0
Refuse/Mixed Carts per Household	1.1	1.1	1.5
Total Carts	525,000	525,000	375,000
Total Cart Cost	$26,250,000	$26,250,000	$18,750,000
Annual Cart Cost [1]	**$3,399,495**	**$3,399,495**	**$2,428,211**

1. Based on amortizing cart cost over a 10 year period.

Table 1-6 provides an estimate of the number of refuse and recycling routes per day based on the number of households, number of carts and set-out rates. BMcD estimated the total number of routes and then used an average cost per route based on experience with other municipal clients. The cost per route includes direct collection costs and amortized capital for collection vehicles, but not administration/overhead or disposal/processing fees.

Table 1-6: Collection Costs

	Scenario 1	Scenario 2	Scenario 3
	Single-Stream Only	Single-Stream Plus Mixed Waste	Mixed Waste Processing Only
Recycling - HHs per Route			
Set-out %	75%	75%	0%
Extra Carts	0%	0%	0%
HHs	1,326	1,326	0
Number of Routes per Day	47.0	47.0	0.0
Refuse/MW - HHs per Route	0	0	0
Set-out %	100%	100%	100%
Extra Carts	10%	10%	50%
HHs	1,054	1,054	800
Number of Routes per Day	59.0	59.0	78.0
Total Routes per Day	106.0	106.0	78.0
Annual Cost per Route	$160,000	$160,000	$160,000
Total Annual Collection Cost	$16,960,000	$16,960,000	$12,480,000

Table 1-7 combines the cart costs from Table 1-5 and collection costs from Table 1-6 to provide a total collection cost for each scenario.

Table 1-7: Total Collection Costs

	Scenario 1	Scenario 2	Scenario 3
	Single-Stream Only	Single-Stream Plus Mixed Waste	Mixed Waste Processing Only
Annual Cart Cost	$3,399,495	$3,399,495	$2,428,211
Annual Collection Cost	$16,960,000	$16,960,000	$12,480,000
Total	**$20,359,495**	**$20,359,495**	**$14,908,211**

Although Scenario 3 results in only one truck driving a household each week, there are more carts per households, which results in fewer households serviced per route. Although the collection cost for Scenario 3 is less than Scenarios 1 and 2, it is not half the cost.

1.6 Waste Composition

In order to conduct the economic analysis, BMcD needed to assume a waste composition for each of three scenarios. In order to keep the analysis consistent, BMcD averaged waste composition data from two publically available reports for the City of Dallas and the City of Chicago. Whereas many waste composition studies focus only on the part of the waste stream that is disposed, the data used for the analysis included both the composition of the waste being disposed and the waste being recycled. Having this data enabled BMcD to use the combined disposal and recycling composition for Scenario 3, the recycling composition for Scenario 1 and 2 and the disposal composition for Scenario 2. Table 1-8 shows the single-stream waste composition and recovery rates used for Scenario 1.

Table 1-8: Scenario 1 - Single-Stream Composition and Recovery

	% of Waste Stream	Percent		Tons	
Material		Recycled	Disposed	Recycled	Disposed
Paper	63.5%	95%	5%	48,996	2,579
Recyclable Plastics	5.3%	95%	5%	4,084	215
Other Plastics	1.8%	0%	100%	0	1,497
Metal	2.6%	95%	5%	2,029	107
Glass	15.6%	95%	5%	12,037	634
Compostable Organics	1.4%	0%	100%	0	1,133
Other Organics	8.6%	0%	100%	0	6,969
C&D Debris	0.5%	0%	100%	0	405
Other	0.7%	0%	100%	0	566
Total	**100.0%**			**67,146**	**14,104**
Percent of Total				82.6%	17.4%

Table 1-9 shows the waste composition and recovery for the mixed waste portion of Scenario 2.

Table 1-9: Mixed Waste Composition and Recovery, Excluding Single-Stream

Material	% of Waste Stream	Percent			Tons		
		Recycled	Composted	Disposed	Recycled	Composted	Disposed
Paper	24.8%	28%	35%	37%	16,794	21,283	22,368
Recyclable Plastics	4.3%	80%	0%	20%	8,320	0	2,080
Other Plastics	11.2%	0%	0%	100%	0	0	27,219
Metal	3.7%	85%	0%	15%	7,672	0	1,354
Glass	5.7%	50%	0%	50%	6,998	0	6,998
Compostable Organics	27.6%	0%	75%	25%	0	50,394	16,798
Other Organics	7.2%	0%	0%	100%	0	0	17,450
C&D Debris	5.6%	0%	19%	81%	0	2,563	11,087
Other	10.0%	0%	0%	100%	0	0	24,371
Total	**100.0%**				**39,785**	**74,240**	**129,725**
Percent of Total					16.3%	30.5%	53.2%

Table 1-10 combined the recovered, composted, and disposed amounts from Table 1-8 and 1-9. This represents the tonnages utilized for Scenario 2, where there is both a single-stream MRF and mixed waste facility.

Table 1-10: Scenario 2 - Combined Single-Stream and Mixed Waste

	Recycled	Composted	Disposed
Single-Stream	67,146	0	14,104
Mixed Waste	39,785	74,240	129,725
Total	**106,931**	**74,240**	**143,829**
Percent of Total	32.9%	22.8%	44.3%

Table 1-11 shows the composition and recovery for Scenario 3. For both Table 1-9 and Table 1-11, the recovery for paper is lower than for plastic and metal. Although the mechanized equipment utilized for the mixed waste facilities is capable of separating paper from other materials, much of the paper becomes soiled when mixed with refuse. Therefore, the amount that can be recovered and sold is more limited for mixed waste processing than from single-stream MRFs. This was confirmed during discussions with AF&PA members that are involved in processing and purchasing recovered paper, as discussed in Section 2. Some of the soiled paper can be composted and the remainder would be disposed.

It is also worth noting that a significant portion of the compostable organics for Table 1-9 and Table 1-11 is food waste. BMcD assumed a significant portion of the food waste could be composted and therefore diverted from disposal. However, any compost facility that would take this material would need to have other sources of wood waste and other compost feedstock to balance out the food waste recovered from the mixed waste facilities.

Table 1-11: Scenario 3 - Mixed Waste Composition and Recovery

Material	% of Waste Stream	Percent			Tons		
		Recycled	Composted	Disposed	Recycled	Composted	Disposed
Paper	29.2%	30%	33%	37%	28,566	31,146	35,028
Recyclable Plastics	4.4%	80%	0%	20%	11,399	0	2,850
Other Plastics	9.9%	0%	0%	100%	0	0	32,150
Metal	3.5%	85%	0%	15%	9,768	0	1,724
Glass	7.2%	50%	0%	50%	11,623	0	11,623
Compostable Organics	24.3%	0%	75%	25%	0	59,214	19,738
Other Organics	7.7%	0%	0%	100%	0	0	24,911
C&D Debris	5.1%	0%	18%	82%	0	3,068	13,541
Other	8.8%	0%	0%	100%	0	0	28,651
Total	**100.0%**				**61,356**	**93,428**	**170,216**
Percent of Total					18.9%	28.7%	52.4%

Table 1-12 shows how the incoming tonnages are allocated between recycling, composting, RDF, and disposal for Scenario 4. Compared to Scenario 3, the recycling tonnage is the same, composting tonnage is lower and disposal tonnage is lower. The decrease in composting and disposal tonnage is offset by the production of RDF.

Table 1-12: Scenario 4 - Mixed Waste with RDF Recovery

Material	% of Waste Stream	Tons			
		Recycled	Composted	RDF	Disposed
Paper	29.2%	28,566	0	42,489	23,685
Recyclable Plastics	4.4%	11,399	0	0	2,850
Other Plastics	9.9%	0	0	25,720	6,430
Metal	3.5%	9,768	0	0	1,724
Glass	7.2%	11,623	0	0	11,623
Compostable Organics	24.3%	0	57,125	2,089	19,738
Other Organics	7.7%	0	0	0	24,911
C&D Debris	5.1%	0	0	3,068	13,541
Other	8.8%	0	0	0	28,651
Total	**100.0%**	**61,356**	**57,125**	**73,366**	**133,153**
Percent of Total		18.9%	17.6%	22.6%	41.0%

Table 1-13 shows the recovery rate for traditional recyclables for several of the mixed waste facilities discussed in Section 2. The recovery rates from this table compare to the 18.9 percent from Table 1-11.

Table 1-13: Mixed Waste Processing Recovery Rates

Facility/Location	Annual Incoming Tons	Traditional Recyclables Recovery Rate[1]	Source
WPMRF: Lincoln, CA	210,000	11.3-13.0%	2013 and 2014 Actuals
CPF: Medina, OH	120,000	6.2% [2]	2012 Actuals
ARC: Indianapolis, IN	260,000	18 - 22% [3]	Contract Target
SMaRT Station: Sunnyvale, CA	190,000	5.0% [4]	2013-2014 Actuals

1. Traditional Recyclables: aluminum, ferrous, cardboard, newspaper, mixed paper, glass, HDPE, PET, and mixed plastics.
2. Only 52% of waste stream was processed at CPF, recovery rate calculated from only waste processed.
3. The contract between the City of Indianapolis and Covanta allows Covanta to determine which materials are deemed recoverable.
4. The SMaRT Station facility diverts a significant amount of recyclables through its curbside program.

1.7 Disposal and Secondary Processing Costs

Disposal costs are wide-ranging and depend on the part of the country the disposal or composting facility is located. For the baseline analysis, BMcD used a disposal cost of $35 per ton and compost tipping fee of $20 per ton. In addition, for residual material, BMcD included $10 per ton for transportation from the processing facility to the disposal location. Table 1-14 shows the total disposal and composting fees included in the analysis. BMcD assumed the compost site would be co-located with the mixed waste waste facility and therefore does not include additional transportation.

Table 1-14: Disposal and Compost Costs

	Per-Ton Fee	Scenario 1	Scenario 2	Scenario 3	Scenario 4
		Single-Stream Only	Single-Stream Plus Mixed Waste	Mixed Waste Only	Mixed Waste with RDF
Refuse Collection Disposal	$35	$8,531,250	$0	$0	$0
Residual Disposal from Processing	$45	$634,682	$6,472,290	$7,660,000	$5,992,000
Compost Tipping Fee	$20	$0	$1,485,000	$1,869,000	$1,143,000

1.8 Revenue

Table 1-15 shows the market price for the commodities recovered from the processing facilities. For the baseline analysis, BMcD used December 2014 index prices for the southwest United States since this geographic area represents somewhat of an average as compared to the other regions. For paper, BMcD used the Pulp and Paper Index (PPI) for the Southwest region and for plastic and metal BMcD used the index value from RecyclingMarkets.net for Houston (Southcentral) region. In the sensitivity analysis discussed in Section 1.10.3, BMcD reviewed the weighted average market values for the last five year and picked a "low" and "high" scenario. These index prices are also included in Table 1-15.

Table 1-15: Per-Ton Market Prices for Recovered Commodities

	Baseline	Low Scenario	High Scenario
Month Represented	Dec 2014	Jan 2010	May 2011
Paper			
Newsprint (ONP 8)	$65	$95	$135
Office Paper	$145	$200	$280
Magazines/Catalogs	$90	$90	$90
OCC/Kraft	$85	$115	$130
Boxboard	$85	$115	$130
Mixed Paper	$60	$85	$130
Other Paper	$0	$0	$0
Plastics			
#1 PET Bottles & Jars	$360	$280	$740
#2 HDPE Containers - Natural	$920	$500	$840
#2 HDPE Containers - Colored	$580	$360	$700
#3-#7 Bottles and Jars	$0	$0	$0
Expanded Polystyrene	$0	$0	$0
Plastic Bags & Film Wrap	$0	$0	$0
Other Plastic	$0	$0	$0
Metal			
Aluminum Used Beverage Containers	$1,600	$1,440	$1,940
Ferrous Metal Food Containers	$120	$80	$115
Other Ferrous Metal	$120	$80	$115
Other Metals	$800	$720	$800
Glass	$0	$0	$0

Using this per-ton value from Table 1-15 and the recovered tonnages from Section 1.6, BMcD developed the revenue estimate for each scenario. In addition to the total revenue, Table 1-16 shows the average revenue per ton and the percent of revenue from the three main commodities: paper, plastic and metal. Although the recovered tonnages are lower for Scenario 3 than for Scenario 1, the revenue for Scenario 3 is almost double that of Scenario 2. This is because the mixed waste facility in Scenario 3 is able to capture more of the high-value plastic and metals from the waste stream as compared to the single-stream MRF in Scenario 1. Paper, which makes up an approximately 30 percent of the waste stream, is lower value than plastic and metals. The mixed waste facilities capture less of the paper due to the paper being soiled, but since more revenue can be generated from plastics and metals, they are generally less focused on marketable recovered paper. Scenario 2 shows the incremental revenue and tonnage from the mixed waste processing facility that would be operated at the same time as a single-stream MRF. The total revenue and tonnage for Scenario 2 includes the revenue and tonnage from Scenario 1 (total revenue of $15.1 million and total recycled tons of approximately 107,000 tons). The revenue and tonnage for recycling in Scenario 4 equals the amounts shown for Scenario 3.

Table 1-16: Revenue for Recovered Commodities

	Annual Revenue			Percent of Revenue		
Material	**Scenario 1**	**Scenario 2 [1]**	**Scenario 3**	**Scenario 1**	**Scenario 2 [1]**	**Scenario 3**
Paper	$3,457,396	$1,132,453	$1,933,639	52%	13%	16%
Recyclable Plastics	$1,921,792	$2,847,313	$4,113,767	29%	34%	35%
Other Plastics	$0	$0	$0	0%	0%	0%
Metal	$1,300,568	$4,453,037	$5,693,643	19%	53%	48%
Glass	$0	$0	$0	0%	0%	0%
Other Materials	$0	$0	$0	0%	0%	0%
Total	$6,679,756	$8,432,804	$11,741,049	100%	100%	100%
Recovered Tons	67,146	39,785	61,356			
Revenue per Ton	$99.48	$211.96	$191.36			

1. Revenue and Percent of Revenue for Scenario 2 is the incremental increase over Scenario 1. The total for Scenario 2 equals the incremental revenue plus the revenue from Scenario 1.

1.9 Impact of Waste-to-Energy

This section provides a general discussion of waste-to-energy as it relates to mixed waste processing facilities and its potential financial impact.

1.9.1 Anaerobic Digestion

Section 1.7 assumes that food waste and non-recyclable paper is composted for $20 per ton, which takes into account the revenue received from the sale of the compost. While composting cost may vary, $20 per ton is typical based on BMcD’s experience with other composting operations.

As an alternative to composting, the mixed waste processor could also divert the organic materials to an anaerobic digestion facility. Anaerobic digestion is the biological conversion of organic matter, in an oxygen-free environment, with a gaseous byproduct that includes methane and carbon dioxide. The gas is typically 40 to 70 percent methane, depending on the feedstock mixture. That methane can be used to generate electricity or can be utilized in direct use applications (e.g., boilers).

While anaerobic digestion may provide a waste-to-energy option for mixed waste facilities, the cost of anaerobic digestion is typically $50 to $70 per ton, which is significantly higher than the $20 per ton cost of the aerobic windrow composting that was assumed for the financial analysis.

1.9.2 Waste-to-Energy for Residuals

Another waste-to-energy option for mixed waste processing facilities is to send some of the residuals to a separate waste-to-energy facility (e.g., incineration, gasification). The facility could be located adjacent to the mixed waste facility to minimize transportation or could be located further away at a separate location.

Some of the soil paper that was assumed to be composted in Scenario 2 and 3, and the non-recyclable plastics and other non-recyclable items were disposed. The mixed waste facility has the option of diverting the soiled paper and non-recyclable plastics to waste-to-energy facility. However, BMcD assumed a $35 per ton disposal fee and a $20 composting fee in the analysis. Based on BMcD’s experience with other waste-to-energy facilities, either operating facilities or facilities evaluated as part of planning process, the tipping fee at waste-to-energy will typically be greater than the $35 disposal fee assumed in the economic analysis. Therefore, while waste-to-energy will allow for greater diversion (not greater recycling), it will be a more expensive option than landfilling in most cases.

1.9.3 Refuse-Derived Fuel

AF&PA also asked BMcD to evaluate the potential impact on mixed waste if the operator would use material from the mixed waste facility, primarily consisting of non-recyclable paper and plastic, to create a refuse-derived fuel (RDF) pellet to supplement coal or natural gas at utility-scale power plants or in commercial/industrial applications. For the purposes of estimating revenue for RDF, the analysis focuses on RDF as a coal or natural gas substitute.

BMcD developed an alternate recovery analysis for mixed waste based on recovery of material for RDF. The RDF material would consist of some mixed waste material that would otherwise be composted and some material that would otherwise be disposed. The net result was that up to 73,000 tons could potentially be diverted for RDF (approximately 60 percent paper and 40 percent plastic). This material would have to be shredded to a size of less than two inches, and then carefully screened to remove metals and other non-conforming material prior to being sent to the pelletizer. A typical pelletizer made for this purpose has the capacity to process five tons per hour. Based on processing 73,000 tons per year and running two shifts per day, BMcD estimates that 5 to 6 pelletizers would be required, accounting for downtime and back-up, at a purchase price of approximately $450,000 per pelletizer.

BMcD estimates total capital costs to be $9 to $12 per ton and operating and maintenance costs to be $15 to $25 per ton, for a total of $24 to $37 per ton. By spending this amount per ton, the mixed waste operator would have a RDF product to market and be able to avoid landfill and composting fees for a portion of the non-recyclable waste stream.

The energy content of the RDF will vary based on the exact content of the pellets, but an average energy content amount is expected to be in the range of 7,000 Btu per pound. Based on 73,000 tons per year, this equates to approximately 1,000,000 MMBtu generated annually from the RDF pellets.

The market value of that energy content would be based on a discount relative to the market price for coal or natural gas. Using coal as an example, assume an average price for coal of $50 per short ton and an energy content of coal of 20.2 million Btu (MMBtu) per short ton.[4] The resulting market value of the energy from coal is $2.48 per MMBtu. As a comparison, natural gas prices have ranged from $2.50 to $4.50 per MMBtu. The RDF pellets, if the operator is able to sell to a coal-fired power plant, would be sold at a discount to $2.48 per MMBtu.

Table 1-17 summarizes the revenue from the RDF based on a range of discounts relative to coal. A similar analysis could be completed for natural gas. Based on an average cost of $30.50 per ton to process the mixed waste into RDF, the cost for processing the RDF exceeds the revenue from selling it to power plants. However, compared to the assumed disposal cost of $35 per ton or compost fee of $20 per ton, there may still be a financial incentive for the mixed waste operator to pursue creating RDF. This analysis does not include transportation since there is also transportation associated with hauling residual to a disposal site. However, if the end user is located considerably further away than the disposal location, then transportation costs should also be included in the evaluation.

In addition, the viability of RDF as a fuel substitute for power plants will vary as the market price for coal or natural gas changes. As the price for natural gas or coal increases, the more financially attractive alternate fuel sources, such as RDF, become. Conversely, when there is a decline in the price for coal or natural gas, power plant operators have less of a financial incentive to seek out alternate fuel sources.

[4] http://www.eia.gov/tools/faqs/faq.cfm?id=72&t=2

Table 1-17: RDF Revenue

Discount Relative to Coal	Annual Revenue	Revenue per Ton	Cost per Ton	Net Revenue (Expense) per Ton
15%	$2,165,180	$29.51	$30.50	($0.99)
20%	$2,037,816	$27.78	$30.50	($2.72)
25%	$1,910,453	$26.04	$30.50	($4.46)
30%	$1,783,089	$24.30	$30.50	($6.20)
40%	$1,528,362	$20.83	$30.50	($9.67)
50%	$1,273,635	$17.36	$30.50	($13.14)

Economic analysis aside, BMcD has experience evaluating potential RDF projects for clients across the U.S. One of the biggest issues faced by companies looking to produce RDF at a large scale is being able to actually sell the product. Power plant operators have been unwilling to purchase the RDF and co-fire the material with coal or other fuels such as natural gas. One large manufacturer of pelletizing equipment that BMcD spoke with as part of this Study said they are not aware of any company selling pelletized RDF to coal-fired power plants in the United States. They were aware of some examples in Europe.

Therefore, while there may be a theoretical economic incentive to create RDF from some of the non-recyclable mixed waste, the market for selling that material in the United States is very limited. Therefore, the operator would be risking several million dollars in up-front capital to create a product in which the market has shown little interest.

While there are examples of using fluff RDF[5] to fuel boilers in commercial or institutional applications, creating the fluff RDF still requires a similar level of capital and operating costs and requires the additional capital cost of dedicated boilers.

1.10 Sensitivity Analysis

The following presents sensitivity analysis for four variables: recycling rate, size of community, recycling market prices, and disposal costs. BMcD also included a discussion of how refuse-derived fuel may impact the analysis.

[5] Fluff RDF is a processed, but less dense form of RDF compared to pelletized RDF.

1.10.1 Recycling Rate

Scenario 1 includes a baseline assumption that 650 pounds (gross) of single-stream recyclables per household per year are collected from residential households. Factoring out contamination and residual, this results in approximately 540 pounds per household per year recycled. A recycling rate of 540 pounds per household is reasonable for a mid-range, mature single-stream program. Many successful single-stream programs are able to exceed this recycling rate, while some programs struggle to reach this point for a variety of reasons. Figure 1-1 shows how changing this assumption impacts the end results for the single-stream only scenario (the dark blue column represents the baseline assumption as reflected in Table 1-1).

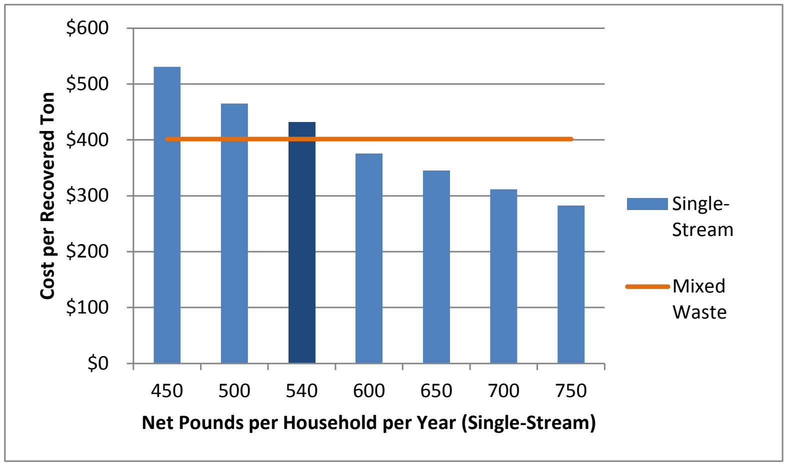

Figure 1-1: Impact of Recycling Rate

As the household recycling rate increases, the cost per recovered ton decreases, and single-stream recycling becomes more financially competitive even for larger communities. Achieving 571 net pounds per household per year results in the cost per recovered ton for Scenario 1 (single-stream) and Scenario 3 (mixed waste) being equal. As a basis for comparison, some successful single-stream programs across the United States have been able to achieve household recycling rates of greater than 700 net pounds per household per year. Despite the recovered cost per ton being lower for Scenario 1 beyond 571 pounds per household per year, the total cost for Scenario 1 still exceeds the total cost for Scenario 3.

1.10.2 Size of Community

The analysis presented in Table 1-1 is based on community of 250,000 households. As discussed, this may represent an individual city, or multiple cities in close geographic proximity. Varying the number of households, and thus tons generated, has an impact on the analysis. Generally speaking, the smaller the community, the more economically feasible single-stream recycling will be compared to one-bin mixed waste processing. However, a larger community with more than 325,000 tons per year would likely need to divert tonnage over that amount to a disposal location or building a second facility. Building a second facility could result in the cost per recovered ton increasing over the baseline. One reason is that the expense per recovered ton for single-stream will fall below that of mixed waste processing. A second reason is that a smaller community may be less able to make the additional capital investment required for a one-bin mixed waste processing facility. The exact break-even point is based on the geography of the area (i.e., hauling distance) and the other variables discussed in this study. However, assuming the facility depends solely on material from the residential waste stream, BMcD would expect mixed waste processing to less economically feasible than single-stream for communities with less than 150,000 households (with the other assumptions holding constant). That threshold number of households decreases with the acceptance of material from other sources. In other words if the number of households is lower, say 75,000 for example, the facility would need to accept material from other sources such as commercial and institutional customers.

1.10.3 Recycling Market

Market prices for recovered commodities can vary by area of the country. The revenue for the economic evaluation was based on December 2014 index data for the southwest United States since this geographic area represents somewhat of an average as compared to the other regions. On the west coast, market prices are oftentimes higher than in other parts of the country. However, disposal costs are also generally higher as well, contributing to higher costs for disposal of residuals. Like all commodities, the market prices also fluctuate based on a variety of market forces. Furthermore, the individual commodities may fluctuate differently from one another. The change in market prices can have an impact on the financial comparison of single-stream and mixed waste. To illustrate this point, BMcD looked at the market low and high over the last five years (Jan 2010 – Dec 2014). The low was January 2010 and the high was May 2012 based on a blended average of market values and composition of the recycling stream. Table 1-18 shows that in January 2010, when markets were at their lowest in the last five years, difference between the cost per recovered ton for single-stream and mixed waste narrowed. When markets were at their highest in the last five years, difference between the cost per recovered ton for single-stream and mixed waste widened. In conclusion, the economic performance of the three scenarios is impacted by the fluctuation in market prices and each scenario is impacted differently based on the quantity of each of the commodities recovered.

Table 1-18: Impact of Changing Market Prices

		Cost per Recovered Ton	
Month	**Market Status**	**Single-Stream**	**Mixed Waste**
Dec 2014	Baseline	$424	$401
Jan 2010	Low	$427	$421
May 2011	High	$376	$323

1.10.4 Disposal Cost

Compared to the other variables discussed, disposal cost has the least amount of impact on the economic comparison. Wide variations in disposal price impact all scenarios, but the difference between the scenarios changes only incrementally. As disposal cost decreases, the cost per recovered ton for single-stream also decreases relative to mixed waste. The opposite occurs when disposal cost increases. With all other baseline variables constant, the break-even point (such that single-stream and mixed waste cost per ton is equal) is approximately $10-$12 per ton, which is lower than virtually all disposal rates in the United States.

1.11 Key Findings

The key findings from this Study are supported by the economic analysis found in Section 1 and the interviews with AF&PA members and mixed waste processors, summarized below and discussed in Section 2. The economic analysis in Section 1 takes into account not only the cost of constructing and operating the recycling facilities, but also the curbside collection costs and disposal costs of residual materials. Figure 1-2 provides an overview of the how single-stream compares to mixed waste based on the size of community and strength of recycling program.

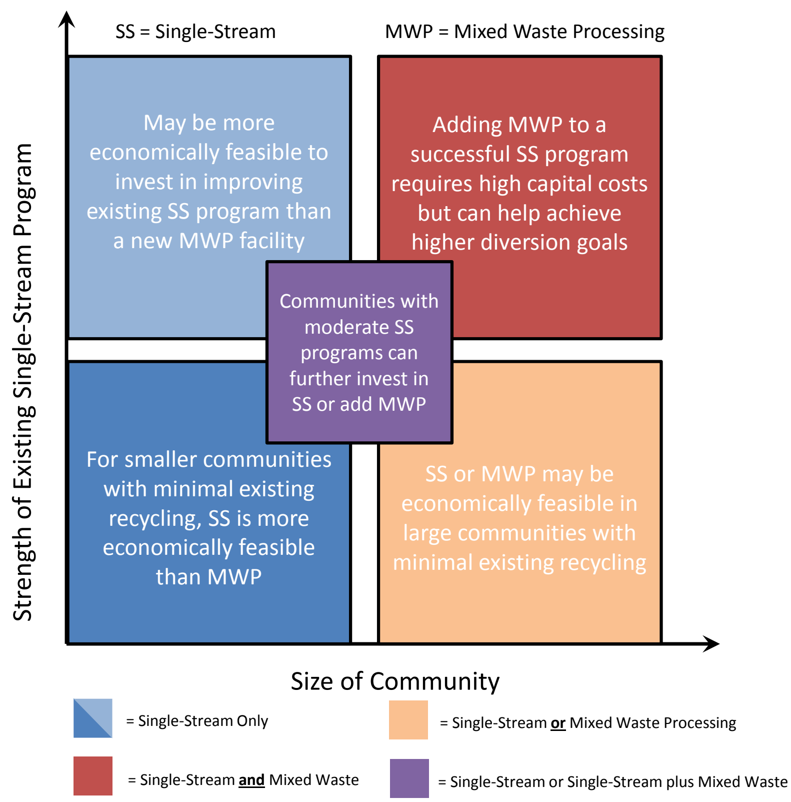

Figure 1-2: Overview of Single-Stream vs. Mixed Waste

1.11.1 Every Situation is Unique

While this Study sought to evaluate the feasibility of mixed waste facilities, the reality is each situation is unique. The economic analysis provides a baseline and discusses the impact of changing several of the assumptions. While the key variables (recycling rate, size of community, recycling market, and disposal cost) under the Economic Comparison were discussed separately, it is important to understand that all four, plus others, may act together to impact the feasibility. For example, in a smaller community, with high recycling rates, low disposal rates, and in a period of low market rates, single-stream will easily be more economically feasible than mixed waste. Conversely, in a very large community with low recycling rates, high disposal costs, and in a period of high market rates, mixed waste processing may be the more economically viable option, assuming the high upfront costs and low recovery of paper are acceptable to the community.

1.11.2 Mixed Waste Facilities Focused More on Recovering Metal and Plastic and Less on Paper

Mixed waste facilities, including those with paired with a waste to energy solution, recover a lower percentage of clean, recyclable paper than single-stream MRFs. Modern single-stream MRFs can divert 90 to 95 percent of the paper collected through single-stream programs and this material is typically sold at $60 to $145 per ton.[6] Single-stream MRFs derive a significant portion of their commodity revenue from recovered paper. Therefore there is a strong incentive to maximize recovery of paper.

The highest and best use of paper is recycling it into other products. Single-stream material recovery facilities are able to recover a higher percentage of paper due to contamination issues associated with mixed waste processing facilities.

The paper in mixed waste facilities commonly becomes soiled from food waste and other constituents of the waste stream. While the processing equipment is capable of physically separating higher percentages of paper, there is not a strong market for soiled paper. Therefore, the ability for mixed waste facilities to recover clean, recyclable paper is reduced compared to single-stream MRFs. The economic model of a mixed waste processing system is based on recovering high percentages of plastic and metal from the waste stream and is less dependent on the recovery of paper. Therefore, the mixed waste facility operator is willing to sell paper at lower grades or to divert more paper to other processes such as composting in order to avoid disposal. Utilizing soiled paper in waste to energy, whether directly or through RDF, reduces expenses relative to disposal, but still generates less revenue than the sale of recycled paper. Further, recycled paper can be made into new products and continue to be recovered and recycled. Whereas paper utilized in a waste to energy process is removed from material use cycle. If mixed waste facilities were to become more commonplace, their decreased dependence on recovering paper has the potential to greatly impact the AF&PA members that rely on purchasing recovered paper.

[6] Index prices for paper based on December 2014 values from the Pulp and Paper Index (PPI) for the Southwest region.

1.11.3 Mixed Waste Processing Requires Greater Capital Investment

Single-stream MRFs require less capital and operating costs than mixed waste processing facilities. When collection costs and refuse disposal (not MRF residual) are taken into consideration, the comparison between the two depends on a number of variables, including but not limited to: size of community, success of existing recycling program, market prices, and disposal prices. While in some cases a one-bin system may seem an "easier" solution for some communities, the high capital cost and lower overall recycling rates may make single-stream a more feasible option.

1.11.4 Adding Mixed Waste Processing to Single-Stream Programs is an Option to Increase Recycling

For a medium to large community that has moderately successful single-stream program, but that is looking to increase their recycling rates the community could seek to increase recycling via a more robust single-stream program or by adding mixed waste processing. To enhance the single-stream program, the community can invest more heavily in public education and develop incentives to increase recycling (e.g., pay-as-you-throw rates). Alternatively, the community can evaluate adding a mixed waste processing facility to supplement the single-stream program. Moving forward with the additional facility for processing mixed waste will require a significant capital investment. Therefore, a community could benefit economically by making an incremental investment in single-stream, as compared to a larger investment in mixed waste processing.

Investing in a strong public education program and developing incentives for residents to recycle is an investment that benefits a single-stream program, but also a community that chooses to introduce mixed waste processing. From the residents' viewpoint, the mixed waste cart should still be viewed as waste and residents should maximize the material diverted to the single-stream cart. Encouraging this behavior will help ensure higher levels of clean paper can be recovered from single-stream while still allowing additional recovery from the mixed waste cart. If residents see both carts as recycling carts, then the program effectively becomes a one-bin mixed waste program where recovery rates of clean paper will decline.

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2.0 INDUSTRY INSIGHTS

Burns & McDonnell researched the status of multiple on-going and proposed mixed waste projects and conducted interviews with paper industry representatives. The purpose of this research and interviews was to obtain specific industry and economic information needed to complete the analysis included in this report. This information was not intended to provide a comprehensive review of the status of mixed waste processing projects, but focused with providing supplemental information to assist with the analysis.

2.1 Case Studies of Existing and Planned Facilities

Based on our industry experience and input from AF&PA, Burns & McDonnell developed case studies from communities that have implemented or have considered implementing (and ultimately decided against) mixed waste processing. The case study communities are summarized in Table 2-1.

Table 2-1: Mixed Waste Processing Case Studies

Facility/Location	Status
Western Placer Materials Recovery Facility (WPMRF): Lincoln, California	Facility began operations in 1995; recently completed update in 2007
Central Processing Facility (CPF): Medina, Ohio	Facility operated from 1993 through January 2015
Infinitus Renewable Energy Park (IREP): Montgomery, Alabama	Facility began operations in April 2014
Advanced Recycling Center (ARC): Indianapolis, Indiana	Facility under contract with Covanta; construction anticipated for 2016
City of Dallas, Texas	Studied mixed waste processing in 2014 and decided not to implement
Escambia County/Emerald Coast Utilities Authority, Florida	Qualifications for mixed waste processing facility were due December 18, 2014
Prince George's County, Maryland	Request for qualifications for waste processing and alternative energy project are due March 12, 2015

These case studies are described in more detail in the sections below. In addition, a matrix of the available information is also provided as Table B-1 in Appendix B for comparative purposes. In addition to the case studies completed, Burns & McDonnell also contacted two additional facilities (Newby Island Materials Recovery Park, Milpitas, California and Sunnyvale Materials Recovery and Transfer Station, Sunnyvale, California) regarding their ongoing operations to better understand their recovery rates.

Although complete case studies were not completed for these two facilities, brief descriptions of the facility and recovery rates have been provided below.

Appendix C provides sources for the data included in this section.

2.1.1 Western Placer Materials Recovery Facility

The Western Placer Materials Recovery Facility (WPMRF) is owned by the Western Placer Waste Management Authority (WPWMA) and operated by Nortech Waste, Inc. (Nortech). The WPMRF began operations in 1995 and completed a $26 million expansion in 2007. The expansion doubled the processing capacity of the facility to 2,000 tons per day and included the replacement and upgrade of processing equipment. The WPMRF processes residential and commercial mixed waste (i.e., one bin program); however, green waste is collected and processed separately. Approximately 210,000 tons are processed annually, serving a population of approximately 300,000. Nortech recovered 11.3% of "traditional" recyclables from the incoming waste from July 1, 2013 through June 30, 2014 (FY 2014). Traditional recyclables included aluminum, ferrous, cardboard, newspaper, mixed paper, glass, HDPE, PET, and mixed plastics.

The WPWMA receives a tip fee of $68 per ton (2014) for incoming municipal solid waste, of which $34.68 per ton is paid to Nortech for processing and the remaining $33.32 per ton (2014) funds capital, other operating and administrative costs. Nortech retains all commodity revenues from the sale of recyclables. In addition, Nortech also receives the California Redemption Value (CRV) on associated products (i.e., aluminum cans, glass, HDPE, and PET) which significantly offsets the costs of operations. For example, in FY 2014, Nortech recognized more than $9 million in commodity revenues, 43% of the revenue was attributed to the CRV. Nortech focuses materials recovery to material types with the higher commodity/CRV rates. Nortech has intentionally scaled back paper recovery efforts in recent years due to lack of market for this material.

2.1.2 Medina County Central Processing Facility

The Medina County Central Processing Facility (CPF) is owned by Medina County and was operated by Envision Waste Services (Envision) until January 11, 2015. The CPF began operations in July, 1993. During 2014, Medina County went out for bids for operations of the CPF with the goal of reducing tipping fees and upgrading fleet and equipment. The County received two proposals, both of which included an increase in tip fees. The County rejected both proposals and went out for bid for the transport and disposal of the County's waste. Kimble Companies was awarded the transport contract for $26.95 per ton and began on January 12, 2015 for a one-year period. The future of the CPF and recycling within

Medina County will be further evaluated during 2015. The County is reevaluating its options as there is a need to implement some version of recycling to comply with the County's solid waste management plan.

During operation of the CPF, tip fees were $61 per ton. Of the $61 per ton, Envision received $42.86 per ton for operations of the CPF and compost facilities, $13.39 per ton went to expenses for the solid waste district and $4.75 per ton went to the State of Ohio EPA fee. Medina County and Envision had a commodity revenues sharing agreement in which Medina County received 50% of the revenues for every dollar over $780,000 annually, with a minimum of $35,000. During 2012, 124,552 tons of waste were generated within Medina County, of which the CPF processed 65,797 tons or 52.8% (the remainder was sent directly to the landfill). Of the material processed, 4,056 of recyclables were recovered (aluminum, cardboard, ferrous, mixed paper, newspaper, plastics, and wood). This represented a recovery rate of 6.2% of the processed waste stream (3.3% of the total waste stream). Revenue from the sale of recyclables totaled $772,080 in 2012.

2.1.3 Montgomery Infinitus Renewable Energy Park

The City of Montgomery entered into a contract with Infinitus Energy in 2013 to build and operate a $35 million mixed waste processing facility. Operations of the Infinitus Renewable Energy Park (IREP), which are contracted out to Zero Waste Energy, LLC, began in April 2014. According to the contract, the City is to deliver 100,000 tons per year of waste to IREP at a tip fee of $28 per ton and residuals from the facility are not to exceed 40% of the total tonnage delivered to IREP (IREP to pay sliding scale tip fee for residuals delivered to the landfill). Also, IREP shall distribute 15% of the net revenue from sales bi-monthly.

Recovery goal rates from the contract include 80% or better for mixed paper, 90% or better for old corrugated cardboard, 90% or better for tin and steel cans, 90% or better for aluminum cans, and 85% or better for plastics. Actual quantities recycled from the facility after operations began were not made available to Burns & McDonnell based on multiple attempts to contact IREP.

2.1.4 Indianapolis Advanced Recycling Center

The City of Indianapolis recently extended its contract with Covanta (who currently operates a waste to energy plant) to include the construction and operations of a $45 million mixed waste materials recovery facility. Construction of the Advanced Recycling Center (ARC) is slated for 2016, and Covanta is currently in the process of obtaining a solid waste permit for the ARC. Indianapolis's current recycling program consists of a voluntary curbside program that costs residents $6 per month. Approximately 10% of the residents subscribe to the program. In 2013, the City generated 267,158 tons of waste, of which, approximately 13,000 tons (4.9%) were recycled and the remainder went to the waste to energy facility. Per the contract, the City cannot increase its recycling over current rates (i.e., implement a new program) without paying a fine of $333,333 per month to Covanta.

In the contract, the City is to pay Covanta $30.04 per ton and revenue sharing will exist after the sixth full year of operation if recovery rates exceed 18% and the blended market value exceeds $225 per ton. The tip fee is set to increase 2.7% per year and there are no penalties to Covanta if the 18% goal is not reached. The City will also continue to receive a share of the steam revenue generated from the waste to energy facility (10.8% based on delivery of 260,000 tons of trash per year). The 18% recycling recovery goal is based on the following breakout (which equates to 18 to 22% recovery):

Table 2-2: ARC Project Recovery Rates

Material	Percentage of Waste Stream	Percent Recyclable	Recovery Rate	Percent Recovered for Recycling
Paper	26%	73%	70-80%	13-15%
Plastics	15%	30%	75-85%	2-3%
Metal	5%	85%	80-90%	3-4%
Total	46%			18-22%

2.1.5 City of Dallas

In February 2013, the City of Dallas (City) passed its Local Solid Waste Management Plan (LSWMP), which included goals to increase diversion to: 40 percent by 2020, 60 percent by 2030, and 80 percent ("zero waste") by 2040. To accomplish these goals, the City is planning to transition away from traditional, disposal-based waste management practices and increase its focus on recovering valuable resources from the waste stream. In 2013, a project team led by Burns & McDonnell evaluated the feasibility of multiple conversion technologies (including mixed waste processing, single-stream recycling, gasification and anaerobic digestion) to facilitate the City's efforts to increase the recycling rate.

After an initial screening analysis, the City completed a detailed analysis for two technologies: mixed waste processing and single-stream recycling. Key decisions affecting the analysis included that the City would continue its single stream program, regardless of any decisions regarding mixed waste. Also, a mixed waste processing system was evaluated based on being integrated into the City's McCommas Bluff Landfill system. Analysis from this study concluded that mixed waste processing was not financially feasible for the City of Dallas, as it would increase net landfill operating costs by more than 30 percent.

Due to the financial concerns, as well as technical risk associated with mixed waste processing, the City decided to focus on continuing to improve the performance of its single stream recycling program.

2.1.6 Escambia County/Emerald Coast Utilities Authority, Florida

The Emerald Coast Utilities Authority (ECUA) issued a request for qualifications (RFQ) for a mixed waste processing facility and recycling services project for Escambia County and the ECUA. Qualifications were due December 18, 2014. The RFQ stated interest in, "the design, permitting, equipment system supply and turnkey facility installation and operation of a source separated recyclables and solid waste processing plant." The RFQ identified that the County/ECUA will deliver 200,000 tons annually to the facility and the facility should have a minimum diversion rate of 75% to meet the State of Florida's recycling goal. The County/ECUA have expressed interest in a facility similar to IREP in Montgomery. ECUA and the City of Pensacola currently have contracts with IREP to process recyclables. Results from the RFQ were not available as of February 2015.

2.1.7 Prince George's County, Maryland

Prince George's County currently has an RFQ out for "waste processing and alternative energy facility public private partnership" and submittals are due March 12, 2015. The County is seeking an alternative to traditional disposal methods as its landfill is slated to reach capacity in 2020. The County is looking for a, "new system to optimize the recovery of recyclables and conversion of organics into compost, fuel or renewable energy… technologies successfully producing energy outputs form waste including pyrolysis, gasification, anaerobic digestion, plasma torch, or other conversion methods producing a fuel or energy product… will be considered by the County." The County currently operates a single-stream MRF and also a food waste composting system. The current waste division rate for the County is 59.44%.

2.1.8 Newby Island Materials Recovery Facility, California

The Newby Island Materials Recovery Facility (Newby MRF) is located in Milpitas, California and is owned and operated by Republic Services. The facility was originally built in 1991 and upgraded in 2012 to the current system. The facility processes waste in separate streams, which include: commercial wet stream, commercial dry stream, and residential and commercial single-sort streams. The Newby MRF receives approximately 600-700 tons per day from the wet and dry commercial streams and 500-600 tons per day of the single-sort streams. The commercial wet stream is processed to remove recyclables and other unsuitable materials and then processed at a dry anaerobic digestion (AD) facility. The commercial dry stream is also processed to harvest recyclables (paper, plastics and metal). The overall wet and dry diversion rate was 78.2% for 2014 (inclusive of all recyclables and AD). The facility estimates that approximately 10% of the total volume recovered is recyclables; however, no data was provided to support this estimate.

Recyclables from the mixed waste processing (commercial wet and dry streams) are combined with the single-sort recyclables before marketing the material. The overall quality of the materials (due to the high amounts of single-sort materials) are typical of any single-sort facility and the Newby MRF has never had a rejected load due to contamination. The facility receives typical commodity rates on the materials plus the California Redemption Value (CRV).

2.1.9 Sunnyvale Materials Recovery and Transfer Station, California

The Sunnyvale Materials Recovery and Transfer Station (SMaRT Station) is located in Sunnyvale, California. The facility is owned by the City of Sunnyvale in partnership with the cities of Palo Alto and Mountain View and is operated by Bay Counties Waste Services. The SMaRT Station originally began operations in 1994 as a mixed waste processing facility and underwent a major upgrade in 2009 to new processing equipment. The SMaRT Station operates two separate streams: a mixed waste stream and a dual-sort recycling stream. The mixed waste stream is unique in that a majority of the recyclables have already been pulled out through the dual-sort recycling system. Only select loads are removed from the SMaRT Station and transported directly to the landfill without being processed.

The SMaRT Station recovers approximately 19.2% of the mixed waste stream, of which, 5% is traditional recyclables. However, it should be noted that the mixed waste stream has already been picked over through the dual-sort recycling program. Paper is positively sorted from the mixed waste stream; however, significant material is left in the residuals due to contamination. Materials recovered from both the mixed waste stream and the dual-sort stream are stored and marketed together; however, they are not comingled prior to baling. The facility has never had a problem with marketing materials as they strive for high quality. The facility is also able to recognize the California Redemption Value (CRV) on commodities.

2.2 Paper Industry Interview Key Findings

To provide additional perspective regarding mixed waste processing facilities, and their potential impacts on the paper recycling industry, Burns & McDonnell conducted confidential interviews with select AF&PA members. Findings from the interviews have been aggregated to represent he overall input from the industry. AF&PA provided Burns & McDonnell with a list of eight AF&PA members to interview. After requesting interviews with these companies, seven companies completed interviews for the project. Key findings from the interviews are summarized below:

- Several of the paper mills have not purchased any paper materials from mixed waste facilities and do not plan on purchasing from them going forward. The reasons were primarily related to the cleanliness of the material (i.e., high levels of contamination and odor).
- Other paper mills have purchased some quantities from mixed waste facilities, but the material purchased met their specifications and they would not purchase unless the specifications are met.
- Paper mills are not willing to purchase a lower grade product for a discount relative to the going market rate of recovered paper.
- Members that send materials to China are concerned with loads with higher levels of contamination being rejected due to the “Green Fence” policy.
- Several members questioned whether there was any domestic market for paper recovered from mixed waste facilities
- One member felt there were four options for paper recovered from mixed waste facilities: (1) waste-to-energy, (2) landfill, (3) export market, or (4) compost.
- Contamination is huge issue for many paper mills because they produce packaging for food other consumer products.
- Several members acknowledged mixed waste is a bigger issue for the paper industry since plastics and metals can more easily be washed.

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APPENDIX A – DETAILED WASTE COMPOSITION DATA

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Table A-1: Detailed Waste Composition

	Mixed Waste	Single-Stream	Mixed Waste after Single-Stream Diverted
Paper			
Newsprint	6.8%	30.6%	3.4%
Office Paper	0.9%	1.5%	0.9%
Magazines/Catalogs	1.4%	3.2%	1.3%
OCC/Kraft	4.7%	11.8%	3.8%
Boxboard	2.5%	2.7%	2.6%
Mixed Paper	4.7%	12.3%	3.5%
Aseptic Containers	0.2%	0.2%	0.2%
Other Paper	7.9%	1.0%	9.1%
Subtotal - Paper	**29.2%**	**63.5%**	**24.8%**
Plastics			
#1 PET Bottles & Jars	1.9%	2.3%	1.8%
#2 HDPE Containers - Natural	0.5%	0.9%	0.5%
#2 HDPE Containers - Colored	0.7%	1.3%	0.6%
#3-#7 Bottles and Jars	1.3%	0.7%	1.3%
Expanded Polystyrene	1.2%	0.1%	1.4%
Plastic Bags & Film Wrap	4.8%	0.9%	5.4%
Other Plastic	3.9%	0.8%	4.4%
Subtotal - Plastics	**14.3%**	**7.1%**	**15.4%**
Metal			
Aluminum Used Beverage Containers	0.7%	0.8%	0.7%
Ferrous Metal Food Containers	1.3%	1.5%	1.2%
Other Ferrous Metal	0.7%	0.0%	0.8%
Other Non-Ferrous Metals	0.9%	0.3%	1.0%
Subtotal - Metal	**3.5%**	**2.6%**	**3.7%**
Glass			
Recyclable Glass Bottles & Jars	6.8%	15.4%	5.4%
Other Glass	0.3%	0.1%	0.3%
Subtotal - Glass	**7.2%**	**15.6%**	**5.7%**
Organics			
Yard Waste	5.7%	0.0%	6.7%
Wood (non C&D)	0.9%	0.0%	1.0%
Food Waste	17.7%	1.3%	19.9%
Fines	2.9%	8.0%	1.8%

	Mixed Waste	Single-Stream	Mixed Waste after Single-Stream Diverted
Diapers	3.7%	0.3%	4.2%
Other Organics	1.0%	0.2%	1.2%
Subtotal - Organics	**32.0%**	**10.0%**	**34.7%**
C&D Debris			
Clean/Unpainted C&D Wood	1.3%	0.1%	1.4%
Treated/Painted C&D Wood	1.3%	0.3%	1.3%
C&D Aggregates	0.4%	0.0%	0.5%
Gypsum Board	0.8%	0.0%	0.9%
Composition Roofing (3-tab)	0.4%	0.0%	0.5%
Other Asphalt Roofing (Built-up)	0.3%	0.0%	0.3%
Other C&D	0.7%	0.1%	0.7%
Subtotal - C&D Debris	**5.1%**	**0.5%**	**5.6%**
Inorganics			
Televisions	0.0%	0.0%	0.0%
Computers	0.0%	0.0%	0.0%
Other Electronics/Appliances	0.8%	0.0%	1.0%
Batteries	0.1%	0.0%	0.1%
Tires	0.2%	0.0%	0.2%
Bulky Waste	0.2%	0.0%	0.2%
Other Inorganics	0.7%	0.0%	0.9%
Subtotal - Inorganics	**2.0%**	**0.0%**	**2.4%**
Textiles	**6.4%**	**0.6%**	**7.3%**
HHW	**0.3%**	**0.0%**	**0.4%**
Total	**100%**	**100%**	**100%**

APPENDIX B – CASE STUDY MATRIX

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Table B-1: Case Studies Matrix

	WPMRF Lincoln, CA	CPF Medina, OH	IREP Montgomery, AL	ARC Indianapolis, IN
Reason(s) to Consider Mixed Waste Processing	Needed to react to AB 939 requirements	County solid waste district was formed in response to House Bill 592 and evaluated successful recycling programs	City had no recycling after failed "orange bag" curbside recycling program	Current recycling rate is approximately 5% and saw mixed waste processing as opportunity to enhance overall recovery
Policy Factors and Reasons to Consider or Eliminate Mixed Waste Processing	AB 939 passed which required a 25% diversion by 1995 and 50% diversion by 2000	House Bill 592 was established in 1988, which created structure for solid waste management. Current State of Ohio recycling goal is to reduce/recycle at least 50 percent of solid waste generated	Increase recycling without incurring additional collection costs	Statewide recycling goal of 50%
Financial Conditions	Tip fee is $68/ton; Nortech receives $34.68/ton processed (2014 – adjusted annually for inflation) and retains 100% of commodity revenues; Nortech does not pay any residual costs	Tip fee is $61/ton; Envision received $42.86/ton and paid 50% of commodity revenues over $780,000 per year back to the County or $35,000 minimum	City pays $28/ton to IREP; IREP to distribute 15% of any net revenue from sales; IREP to pay City sliding scale on residuals based on amount; Residuals not to exceed 40%	City pays $30.04/ton to Covanta; Covanta to share revenues after sixth year of operation if recovery exceeds 18% and blended value exceeds $225/ton
Market Rates (per Ton) for Material Captured by Process	• Cardboard: $224-254 • Newspaper: $155-157 • Mixed Paper: $96-103 (FY 2013-2014 Data)	Data not available	Data not available	Data not available; facility not operating
Operational Considerations	• WPWMA delivers 210,000 tons annually to facility • Larger waste stream to analyze with 100% participation • Having a competent and stable work force is key	• County delivered 120,000 tons to facility annually; 52% of which was processed • Flow control enacted for Medina County	• City to delivery 100,000 tons to facility annually • Equipment supplied by BHS: includes tri-disc screen, air separation, and optical sorting	City to delivery 260,000 tons to facility annually

	WPMRF Lincoln, CA	CPF Medina, OH	IREP Montgomery, AL	ARC Indianapolis, IN
Percentage of Recovered Material[1]	11.3 – 13.0% (FY 2013 and 2014 Data)	3.3% of total waste stream or 6.2% of processed waste stream in 2012	• Contract goal recovery rates of 80% or better for mixed paper; 90% or better for OCC; 90% or better for tin and steel cans; 90% or better for aluminum cans; and 85% or better for plastics. • Overall diversion goal of at least 60% per contract (all materials).	Goal of 18% recovery; however no penalty if goal is not met. Based on 70-80% recovery on recyclable paper, 75-85% recovery on recyclable plastic and 80-90% recovery on metal
Level of Effort for Permitting and Regulatory Compliance	Data not available	Data not available	Data not available	Currently in the process of obtaining solid waste permit for facility
Technical and Environmental Risks Associated with the Technology	Reduction of environmental risks for the WPWMA landfill as each load is checked and unacceptable wastes are removed prior to disposal	Data not available	Data not available	Covanta believes there is little risk as facilities are operating successfully in Europe
Issues Associated with the Sale of Commodities	Paper market demand has declined in recent years (quality requirements have increased), therefore have scaled back efforts to recycle this material	Data not available	Data not available	Contract states that Covanta will meet the industry standard of less than 5% contamination on recovered materials
Challenges and Problems Associated with Mixed Waste Processing	• Large capital start-up costs • Need flow control (or similar) to sustain • Have to have a good handle on waste stream composition • Do not want recyclables taken out up-stream	Data not available	Data not available	None presented from Covanta's prospective; however, facility is not operational yet
Any non-municipal funding support from federal or state governments?	CRV revenues obtained from aluminum cans, glass, HDPE, and PET (43% of total commodity revenues in FY 2014)	Data not available	Data not available	No, facility is privately funded by Covanta

Table B-2: Case Studies Matrix, Continued

	Dallas, TX	Escambia County/ECUA, FL	Prince George's County, MD
Reason(s) to Consider Mixed Waste Processing	Evaluated options to increase the City's recycling rate to achieve "zero" waste goals	Interest to increase the recycling rate	Not solely interested in mixed waste processing, interested in what technologies are on the market as landfill is slated to be full in 2020
Policy Factors and Reasons to Consider or Eliminate Mixed Waste Processing	Eliminated mixed waste processing due to technical risk and increased costs	State of Florida 75% recycling goal	Maryland Recycling Network goal of40%
Financial Conditions	Adding mixed waste processing would have increased landfill operating costs by 30%	Data not available; on-going procurement	Data not available; on-going procurement
Market Rates (per Ton) for Material Captured by Process	Feasibility study utilized five-year averages for market pricing	Data not available; on-going procurement	Data not available; on-going procurement
Operational Considerations	Feasibility analysis based on mixed waste processing facility operating in sync with City's landfill operations	• County/ECUA to deliver 200,000 tons annually to facility • County ordinance in place for all commercial and residential waste to be delivered to Perdido Landfill	County landfilled approximately 350,000 tons in 2010
Percentage of Recovered Material[1]	Assumed mixed waste facility would capture 18.4% of traditional recyclables	RFQ requires 75% diversion rate	Data not available; on-going procurement
Level of Effort for Permitting and Regulatory Compliance	Since facility would be located at an existing permitted landfill, would have required registration process to update the existing permit	Data not available; on-going procurement	Data not available; on-going procurement
Technical and Environmental Risks Associated with the Technology	Concern over large capital investment and recycling recovery rates	Data not available; on-going procurement	Data not available; on-going procurement

	Dallas, TX	Escambia County/ECUA, FL	Prince George's County, MD
Issues Associated with the Sale of Commodities	Concern marketability of key recyclables (e.g. paper)	Data not available; on-going procurement	Data not available; on-going procurement
Challenges and Problems Associated with Mixed Waste Processing	Cost and concerns with lack of similar commercial-scale facilities in Texas	Data not available; on-going procurement	Data not available; on-going procurement
Any non-municipal funding support from federal or state governments?	None assumed for the financial analysis	Data not available; on-going procurement	Data not available; on-going procurement

APPENDIX C – CASE STUDY SOURCE INFORMATION

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Western Placer Materials Recovery Facility References

The following data sources were utilized to compile data on the WPMRF:

- Recycling Today Article, “Not Your Father’s MRF”, August 6, 2009: http://www.recyclingtoday.com/Article.aspx?article_id=23872
- Materials Recovery Facility Technology Review for Pinellas County, Florida, September 2009: http://www.dep.state.fl.us/waste/quick_topics/publications/shw/recycling/InnovativeGrants/IGYear9/finalreport/Pinellas_IG8-06_Technology_Review.pdf
- Phone interview with WPWMA staff, January 9, 2015.
- WPWMA Website: http://www.wpwma.com/index.html

Medina County Central Processing Facility References

The following data sources were used to gather data on the CPF:

- Ohio EPA 2009 Solid Waste Reduction and Recycling Statistics, February 2011: http://epa.ohio.gov/portals/34/document/guidance/gd_1008.pdf
- Alternatives for Future Medina County Operations Report prepared for Medina County Solid Waste Management District, October 29, 2013: http://www.recyclemedinacounty.com/downloads/cpfstudy.pdf
- Findings of Fact and Recommendation, Medina County Solid Waste Technical Advisory Commission, January 2014: http://www.recyclemedinacounty.com/downloads/tacfinal.pdf
- Recycling Today Article, “Ohio County Rejects Recycling Facility Proposals”, November 5, 2014: http://www.recyclingtoday.com/medina-county-rejects-mixed-waste-processing-bids.aspx
- The Post Newspapers, “County Considering New Trash Options”, November 11, 2014: http://www.thepostnewspapers.com/medina_county_news/article_31af0627-50bb-5e17-a77d-8bbca3db60a1.html
- Medina County Transport and Disposal Services RFP, November 13, 2014: http://sanitaryengineer.co.medina.oh.us/downloads/2014cpfservices.pdf
- Medina County Solid Waste District Central Processing Facility Fact Sheet, November 2014: http://www.recyclemedinacounty.com/downloads/nov2014factsheet.pdf
- The Post Newspapers, “Judge Lifts Restraining Order on CPF Bids”, December 29, 2014: http://www.thepostnewspapers.com/medina_county_news/article_c30612d4-ec73-5e94-b29a-f3182241d3d9.html

- Medina County Solid Waste District Central Processing Facility Fact Sheet, December 2014: http://www.recyclemedinacounty.com/downloads/dec2014factsheet.pdf

Montgomery Infinitus Renewable Energy Park References

The following data sources were reviewed to compile data on IREP:

- Municipal Solid Waste Feedstock Supply Agreement between IREP and City of Montgomery, June 4, 2013.
- "$35 million residential recycling center opens in Montgomery; brings 100 jobs", April 14, 2014: http://www.al.com/news/montgomery/index.ssf/2014/04/35_million_residential_recycli.html
- Waste and Recycling "Innovative technologies and sustainable solutions", Issue #3, Volume: 4: http://www.waste-recyclingme.ae/article-details.php?ArticleID=1234664
- Recycling Today, "Leaps and bounds ahead", November 10, 2014: http://www.recyclingtoday.com/rt1114-municipal-recycling-Montgomery-Alabama.aspx
- "Talking Trash: A look inside Montgomery's recycling facility", November 24, 2014: http://www.wsfa.com/story/27472026/talking-trash-a-look-inside-montgomerys-recycling-facility

Indianapolis Advanced Recycling Center References

The following data sources were used to gather data on the ARC:

- Covanta, "$45 Million Advanced Recycling Center will add Green Jobs and Increase Recycling in Indy by 500 percent", June 18, 2014: http://www.covanta.com/en/news/press-releases/2014/Jun-18.aspx
- First Amendment (dated August 2014) to the Amended and Restated Service Agreement dated July 25, 2008 between Covanta and the City of Indianapolis.
- "City's Covanta deal discourages rival recycling programs", August 4, 2014: http://www.ibj.com/articles/48888-city-s-covanta-deal-discourages-rival-recycling-programs
- "City board approves recycling deal with Covanta", August 6, 2014: http://www.ibj.com/articles/48928-update-city-board-approves-recycling-deal-with-covanta
- Resource Recycling, "Indianapolis gives final approval to Covanta MRF", August 13, 2014: http://resource-recycling.com/node/5162

- Indy Star, "City sued over $45M recycling center deal", September 11, 2014: http://www.indystar.com/story/news/politics/2014/09/11/city-sued-m-recycling-center-deal/15469843/
- MSW Management, "A Dirty MRF for Indy? Politics Abound", December 22, 2014: http://www.mswmanagement.com/MSW/Articles/A_Dirty_MRF_for_Indy_Politics_Abound_27910.aspx
- City of Indianapolis Website, Curbside Recycling: http://www.indy.gov/eGov/City/DPW/SustainIndy/RRR/Recycle/Pages/CurbsideRecycling.aspx

Dallas, Texas References

The following data sources utilized as references for the City of Dallas:

- Resource Recovery Planning and Implementation Study http://dallascityhall.com/departments/sanitation/pages/rfcsp.aspx

Escambia County/Emerald Coast Utilities Authority, Florida References

The following were utilized as data sources on the proposed Escambia County/ECUA facility:

- Pensacola Today, "An agreement on Escambia recycling?", July 30, 2014: http://pensacolatoday.com/2014/07/agreement-escambia-recycling/
- Request for Qualifications for Mixed Waste Processing Facility & Recycling Services, November 18, 2014: http://www.ecua.fl.gov/system/files/Bids%2015/Bid%202015%2008%20RFQ%20Mixed%20Waste%20Processing%20Facility%20&%20Recycling%20Services.pdf

Prince George's County, Maryland References

The following were used as data sources on the proposed Prince George's County facility:

- Phone interview with Prince George's County staff, January 2, 2015.
- Prince George's County website, "Prince George's County Seeks to Recover Waste to Produce Clean Energy", November 13, 2014: http://www.princegeorgescountymd.gov/sites/EnvironmentalResources/News/Pages/Waste-to-Energy-RFQ.aspx

- Prince George's County website, Materials Recycling Facility: http://www.princegeorgescountymd.gov/sites/WasteManagement/Services/Recycling/MaterialRecycling/Pages/default.aspx
- "Prince George's County & MES Cut Ribbon on New Food Scrap Composting Project at Western Branch Yard Waste Composting Facility", October 25, 2013: http://www.menv.com/blog/prince-georges-county-mes-cut-ribbon-on-new-food-scrap-composting-project-at-western-branch-yard-waste-composting-facility/
- Department of Environmental Resources: Overview and Key Initiatives Presentation, April 2014: http://www.pgplanning.org/Assets/Planning/Programs+and+Projects/Speaker+Series+2014/SS+April+2014.pdf

Newby Island Materials Recovery Facility, California References

The following data source was used to gain information on the Newby Island MRF:

- Phone interview with Republic Industries, Inc. staff, January 22, 2015.

Sunnyvale Materials Recovery and Transfer Station, California References

The following data sources were utilized to gain information on the SMaRT Station:

- Phone interview with City of Sunnyvale staff, January 23, 2015.
- SMaRT Station Annual Report 2013-2014 provided by City staff.
- SMaRT Station Operation Agreement, June 30, 2014: http://sunnyvale.ca.gov/Departments/EnvironmentalServices/Garbage,RecyclingandWasteReduction.aspx

APPENDIX D – FINANCIAL INCENTIVES

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FINANCIAL INCENTIVES

Government incentives – whether at the federal, state or local levels – can potentially provide financial benefits for a variety of solid waste and recycling projects. These funding sources are often provided on a competitive basis, and are not specific to mixed waste processing. If a project can secure additional funding, it will typically allow for a reduction in the capital and/or operating costs. This section provides an overview of potential governmental incentives that could utilize or have historically been utilized on other solid waste management or recycling projects.

AMERICAN RECOVERY AND REINVESTMENT ACT

The American Recovery and Reinvestment Act (ARRA) was passed in February 2009 in response to the economic crisis and is commonly referred to as the Stimulus Package or The Recovery Act. The ARRA allocated $840 billion in tax benefits, contracts, grants and loans, and entitlements. Although there is not a specific end date to The Recovery Act, the funds have been fully allocated and therefore are not available for future projects.

Example: Enerkem received a $50 million grant from the ARRA to help finance a 300 ton per day biorefinery in Pontotoc, Mississippi that will use dried biomass as feedstock. The facility will be a gasification system combined with a gas cleaning and conditioning process; however, it has yet to be constructed.

Applicability to Mixed Waste Processing: As mentioned above, the ARRA funds have been fully allocated; therefore, there is not funding available for future mixed waste processing projects.

More information on the ARRA is available at: http://www.recovery.gov/arra/Pages/default.aspx

SECTION 45 PRODUCTION TAX CREDITS

Section 45 Production Tax Credits (PTCs) were initially enacted as part of the Energy Policy Act of 1992 and have most recently been extended through the ARRA. The PTCs are a per kilowatt hour tax credit for electricity generated from a qualified energy resource sold to a third party. The PTCs are available for ten years following the date that the facility was originally placed into service. In order to qualify for the PTCs, a facility must have begun construction before January 1, 2015.

Example: PTCs are primarily used by the private sector and not easily identifiable in a public records search. However, an example of a facility able to recognize Section 45 PTCs would be a mixed waste processing facility that uses incineration to produce energy and sells it to a third party. Covanta has stated that waste to energy projects are eligible to claim Section 45 PTCs, but "…as a practical matter, WTE facilities have been unable to utilize the PTC for new facility development because of the temporary nature of the incentive combined with the long project lead times involving local government procurement laws, and lengthy construction cycles…" However Covanta stated in its Form 10-K for the fiscal year ended December 31, 2014 that they plan to utilize production tax credit carry forwards to minimize federal income tax in the future, which implies that they have developed WTE facilities in the past that met the Section 45 eligibility requirements. While these PTCs are likely from some form of WTE project, it is uncertain whether the projects had a mixed waste processing component, aside from the pre-processing that often occurs at WTE facilities to remove unwanted materials from WTE process.

From broader solid waste management perspective, a landfill gas to energy (LFGTE) project that has utilized the Section 45 PTCs is the Lancaster County Solid Waste Management Authority located in Pennsylvania.

Applicability to Mixed Waste Processing: A recent bill has passed through the senate subcommittee extending the construction start date to December 31, 2016 in order for facilities to be eligible for Section 45 PTCs. The previous deadline for beginning construction was defined as December 31, 2014 as defined in Notice 2015-25 from the Internal Revenues Services (IRS). The Section 45 PTCs excludes recycled paper that is source separated; however, they do apply to potentially recyclable paper that is comingled within the waste stream. Mixed waste processing projects would need a form of energy recovery in the process in order to qualify for a PTC.

More information on Section 45 PTCs is available at: https://www.law.cornell.edu/uscode/text/26/45

QUALIFIED ENERGY CONSERVATION BONDS

The Qualified Energy Conservation Bond (QECB) allows bonds to be issued at low interest rates to fund energy conservations projects. The QECB was first passed by Congress in October 2008 for a maximum of $800 million; however when the ARRA was passed in 2009, Congress increased the amount to $3.2 billion. The U.S. Department of Treasury subsidizes the issuer's borrowing costs by allowing the bond investors to receive tax credits instead of interest payments (tax credit bond) or cash rebates to subsidize net interest payments (direct subsidy bonds). QECB subsidizes projects related to energy use reduction in buildings and mass transit, green community programs, renewable energy production, and research and development.

Example: Lebanon, Tennessee received a QECB to fund a waste-to-energy (WTE) facility that will generate up to 300 kilowatts of electricity from 64 tons of waste daily. The facility is a gasification plant that will use blended wood waste, scrap tires, and sewer sludge as feedstock. The bond will be used to repay about 70 percent of the interest expense.

Applicability to Mixed Waste Processing: Mixed waste processing projects would need a form of energy recovery in the process in order to qualify for a QECB.

More information is available at: http://energy.gov/eere/slsc/qualified-energy-conservation-bonds

PRIVATE FUNDING SOURCES

While there are various potential private funding sources, this section describes the Closed Loop Fund and Bloomberg Philanthropies. The Closed Loop Fund (CLF) was created to increase recycling rates and is funded by consumer goods companies and retailers. The CLF provides zero interest loans to municipalities and low interest loans to private companies. The goal for CLF is to invest $100 million in recycling infrastructure in the next five years.

Bloomberg Philanthropies focuses on environment, public health, education, government innovation and the arts. Bloomberg also has an initiative dubbed the "Mayors Challenge" where cities submit innovative ideas to improve city life and have a chance at winning a $5 million grand prize or one of four additional $1 million grants.

Example: During the 2012-2013 Mayors Challenge, the City of Houston won a Bloomberg Philanthropies grant of $1 million for their One Bin for All (OBFA) initiative. The City is currently in the process of evaluating proposals to design, construct and operate a facility to reach the 75% diversion rate goal.

Applicability to Mixed Waste Processing: Mixed waste processing facilities could apply for a grant from the CLF or attempt to submit to the next Bloomberg Philanthropies Mayors Challenge for funding.

More information can be found at: http://www.closedloopfund.com/ and http://www.bloomberg.org/

RENEWABLE ENERGY CREDITS

Renewable Energy Credits (RECs) are exchangeable energy credits that represent that electricity was generated from a renewable energy source. RECs must be certified to ensure they are properly counted for and no double counting takes place. RECs can be sold or traded on a voluntary basis or to comply with renewable energy utility requirements.

Example: The City of Indianapolis recently signed contract with Covanta to construct a mixed waste materials recovery facility in front of their existing waste to energy facility. The waste to energy facility produces 4,500 pounds of steam sold per ton of solid waste. Citizens Thermal Energy (CTE) purchases the steam to power downtown Indianapolis. CTE would be able to claim RECs from the use of the steam as an alternative energy source.

Applicability to Mixed Waste Processing: Mixed waste processing facilities would not be eligible to receive RECs; however, if the facility produced an alternative fuel, they create the opportunity for RECs to be created. Ultimately the user of the alternative fuel would recognize the RECs.

STATE GRANT/FUNDING PROGRAMS

Various state programs exist to incentivize communities to increase recycling rates. A few state programs are highlighted below:

- California has a beverage container recycling program and containers are subject to a California Redemption Value (CRV) where deposits are added to the cost of the containers. **Example**: The Western Placer Materials Recovery Facility receives the California Redemption Value (CRV) on recovered materials from the facility, which significantly offsets the costs of operations.
- Minnesota has an Environmental Assistance (EA) grants program to provide financial assistance for researching, developing, and implementing projects related to waste management and prevention. **Example**: The City of Becker received a $1 million matching grant for the construction of a recyclables materials recovery facility.
- Texas has a solid waste and recycling grants program that distributes funding annually to the state's 24 planning regions, which in turn distribute funds to local governments via a competitive process. Recycling programs are eligible for funding. **Example**: The North Texas Municipal Water District received a grant to evaluate the feasibility of a construction and demolition debris material recovery facility.

Applicability to Mixed Waste Processing: Mixed waste processing facilities have the potential to recognize different state grant and funding programs depending on where the facility is located.

NEW MARKET TAX CREDIT

The New Market Tax Credit (NMTC) Program is a federal program operated by the Department of Treasury that provides investors with federal tax credits for qualified development in low income communities. The tax credit is provided to a specialized financial institution called a Community Development Entity (CDE) who invests in the NMTC applicant. The tax credit provided to the investor is claimed over a seven-year credit period. In each of the first three years, the investor receives a tax credit equal to five percent of the total amount paid for the stock or capital interest at the time of purchase. For the next four years, the value of the tax credit is six percent annually. The tax credit can be applied for multiple times in a row for the same project.

Example: City of Albuquerque (Friedman Recycling) utilized new market tax credits as a part of its efforts to build and operate a new single-stream material recovery facility in the City.

Applicability to Mixed Waste Processing: Mixed waste processing facilities would be eligible for the NMTC if constructed in a qualifying area.

Further information regarding the NMTC is available at: http://www.cdfifund.gov/what_we_do/programs_id.asp?programID=5

PRIVATE ACTIVITY BONDS

Private activity bonds provide tax-exempt financing for the furtherance of governmental and qualified purposes, which may include the construction of Solid Waste Disposal (which could include various types of recycling activities) facilities. Qualified private activity bonds are issued by a state or local government, the proceeds of which are used for a defined qualified purpose by an entity other than the government issuing the bonds.

Qualified private activity bonds must be approved by the governmental entity issuing the bonds and, in some cases, each governmental entity having jurisdiction over the area in which the bond-financed Facility is to be located. Public approval can be accomplished by either voter referendum or by an applicable elected representative of the governmental entity (e.g. Dallas City Council) after a public hearing following reasonable notice to the public.

Example: The City of Dallas City Council approved the issuance of private activity bonds for the landfill gas to energy project at the McCommas Bluff Landfill as required by IRS regulations. The contractor, Dallas Clean Energy, used a conduit issuer, Mission Economic Development Corporation, as the issuer of the private activity bonds.

Applicability to Mixed Waste Processing: Mixed waste processing facilities could be eligible for private activity bonds.

Further information regarding tax-exempt private activity bonds is available at: http://www.irs.gov/pub/irs-pdf/p4078.pdf