



# Materials Recovery Facility Feasibility Report

Prepared for:

**City of Tucson  
Environmental Services**

Prepared by:



**Gershman, Brickner & Bratton, Inc.**  
8550 Arlington Blvd., Suite 203  
Fairfax, VA 22031  
703-573-5800

**November 24, 2008**



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## I. INTRODUCTION

The City of Tucson, through its Department of Environmental Services (“ES”), operates a comprehensive recycling program for City residents and small businesses. Collection is provided by a fleet of compaction style trucks outfitted with automated side loader equipment. Those trucks deliver loads to a material recovery facility (MRF). The City contracts with Waste Management Recycle America (WMRA) for services to process collected materials, prepare them for shipment to markets, and to conduct ongoing marketing of these materials. The first extension term of the contract, having commenced on July 1, 2007, expires on June 30, 2010, with a second extension term available to run through June 30, 2012. Several alternatives are available to the City for MRF services after 2010 and 2012.

To best serve the City’s interests after the current contract expires, the City contracted with Gershman, Brickner & Bratton, Inc. (GBB) for this MRF Feasibility Study to assess alternative approaches for MRF services beginning in July 2010. Assisting GBB as a subcontractor is the firm of RRT Design & Construction, Inc. (RRT). This MRF Feasibility Study (the “Feasibility Study”) identifies the City’s alternatives, presents conceptual design of a MRF that, if built to serve the City, would serve the City for 15 years or more. Also, the Feasibility Study describes advantages and disadvantages for each of the alternatives and is intended to serve as input for the City’s decision-making process regarding the approach for MRF services when the current contract expires.

This Feasibility Study is broken down into five sections beyond this introductory section:

- A brief review of other recyclable materials generating sectors, including other municipalities, Pima County, and the private sector;
- An evaluation of MRF services, including four alternatives that vary among City and private ownership and operation;
- An evaluation of materials that could be added to the program and be processed at the MRF;
- A discussion of contractual terms for future MRF services; and
- Conclusions and Recommendations

## **II. RECYCLABLE MATERIALS PROCESSING NEEDS IN TUCSON AREA**

This section presents a general assessment of opportunities for the City of Tucson to receive and process recyclable materials collected from other local government-sponsored collection programs. The City of Tucson is located in Pima County which covers approximately 9,189 square miles and has an estimated population of 1,023,000 people, according to the Pima Association of Governments (PAG). The City of Tucson makes up over half of this population with 549,000 residents.

Tucson is currently the largest city in southern Arizona, the second largest city in the state, and is still growing. PAG projects that the current population of the Tucson Metropolitan Area will double by 2055. The City is growing in area as well as population through annexation. From its initial two-square-mile configuration, Tucson has grown to 246 square miles through 215 annexations.

PAG is made up of the Cities of Tucson and South Tucson; Pima County; the Towns of Marana, Oro Valley and Sahuarita; the Pascua Yaqui Tribe, and the Tohono O'odham Nation. These jurisdictions cooperate on a variety of planning and service activities for the benefit of the region.

The growth in the City of Tucson's population and size has increased the amount of waste the Department of Environmental Services (ES) must manage. ES provides once-per-week recycling and refuse collection services for residences within the incorporated limits of the City. Curbside recycling, currently serving 140,000 households, is collected single-stream and in carts on the same day as refuse. Small businesses receiving cart refuse collection by the City are also participants in the recycling collection. In addition, ES provides other solid waste services, such as twice-a-year residential curbside brush and bulky pickup, landfill operations, neighborhood cleanup, annual Christmas tree recycling and household hazardous waste events. These basic services are provided for a cost of \$14 per residence per month. ES also provides recycling and refuse collection services to approximately 5,000 businesses in competition with private haulers. Of these, approximately 600 receive recycling collection. In addition, ES operates 15 drop-off recycling centers for residents and businesses that do not receive curbside collection. These programs collected approximately 46,000 tons of recyclable materials in FY2008 and returned approximately \$1.5 million in revenue sharing to the City of Tucson, net of tip fee payments.

### **A. Potential Waste Growth**

The City of Tucson, as mentioned above, is growing. ES estimates this growth rate at 1.5 percent per year. PAG estimates that Pima County will grow at an average rate of 2.1 percent a year over the next 15 years. The projected growth of the City and the County, including individual PAG members, for a period extending 20 years from 2011, is presented in Table II-1.

**Table II-1 - Population Projection City of Tucson and Pima County  
Showing Individual PAG Members**

	2006	2011	2016	2021	2026	2031
City of Tucson (1)	534,685	576,008	620,524	668,480	720,143	775,799
Association of Governments (PAG)						
City of South Tucson	5,490	6,229	7,249	8,170	9,001	9,746
Town of Marana	31,860	36,148	42,070	47,412	52,236	56,561
Town of Oro Valley	33,843	38,398	44,689	50,363	55,487	60,081
Town of Sahuarita	18,199	20,648	24,031	27,082	29,838	32,309
Pascua Yaqui Tribe	14,567	16,528	19,235	21,678	23,883	25,861
Tohono O'odham Nation (2)	14,270	16,191	18,843	21,236	23,396	25,333
Unincorporated Pima County	328,366	372,561	433,597	488,650	538,374	582,946
<b>Total Pima County (3)</b>	<b>981,280</b>	<b>1,082,710</b>	<b>1,210,238</b>	<b>1,333,070</b>	<b>1,452,360</b>	<b>1,568,636</b>

- (1) Projected growth rate, ES
- (2) Estimate, 2000 Census reported
- (3) Projections from PAG

As population increases, waste generation also increases. According to the U.S. EPA, the average U.S. resident generates approximately 4.6 pounds of waste per day. Using the population projections above, Pima County residents could be generating an additional 1,350 tons of trash per day by 2031.

## B. Transportation Issues

Pima County, which encompasses the City of Tucson, is approximately 100 by 80 miles, making it very transportation-intensive and expensive to collect recyclables from the more remote areas of the County. The County is bordered on four sides by Mexico and six other counties. No significant population centers exist in adjacent counties within 20 miles or so of the Pima County line. Given the lack of concentrated population centers and the long distances, the opportunity for the City of Tucson to receive and process recyclable materials from these areas is minimal.

Transportation logistics and costs are two significant factors when considering the feasibility of recyclable materials to be delivered to a MRF in Tucson from the unincorporated portions of the County. If the County and the other members of PAG develop recycling programs, the transportation cost issue will be mitigated by the fact that materials must be transported to markets regardless of where they're collected.

## C. Potential Recycling

Except for in the City of Tucson, Pima County has had very little recycling in the past, with the entire unincorporated portion of the County recovering only 1,600 tons during FY2008 (July 2007 through June 2008). Discussions with the City of South Tucson indicated that they recovered "very little" recycling. GBB has estimated the future recycling quantities from the City of Tucson and the other PAG members based upon their current programs. These projections are presented in Table II-2. Based on the population of the County, less the City of Tucson, there is potential for an additional 21,000 tons of recovered recycled

materials in 2011. This estimate is based on the estimate that the capture rate of the County would be one half of that of the City of Tucson at that time. The estimate assumes that the County and the other PAG members make a major investment in new recycling collection programs which will overcome some but not all of the collection and transport issues presented by the County geography and demographics. It should be further acknowledged that the County does not require resident to separate recyclables nor subscribe to a recycling collection service. Some haulers do offer curbside recyclables collection services for an additional monthly fee, but few subscribe for it.

**Table II-2 - Recycling Tonnage Projections  
 City of Tucson and Pima County  
 Showing Individual PAG Member**

	2006	2011	2016	2021	2026	2031
City of Tucson	44,727	48,206	51,908	55,919	60,241	64,896
Pima Association of Governments (PAG)						
City of South Tucson		261	303	342	377	408
Town of Marana		1,513	1,760	1,984	2,186	2,367
Town of Oro Valley		1,607	1,870	2,107	2,322	2,514
Town of Sahuarita		864	1,006	1,133	1,249	1,352
Pascua Yaqui Tribe		692	805	907	999	1,082
Tohono O'odham Nation		677	788	889	979	1,060
Unincorporated Pima County	1,600	15,590	18,144	20,448	22,528	24,393
<b>Total Pima County</b>	<b>46,327</b>	<b>69,409</b>	<b>53,508</b>	<b>57,519</b>	<b>61,841</b>	<b>66,496</b>

Future tonnages estimated by GBB.

Section IV of this report presents a conceptual design of a MRF that would have adequate capacity to process the City's materials through the end of the planning period. Design and operational approaches would be applied to accommodate with good cost efficiencies the City's materials during the early years of the project (less than 50,000 tons per year [tpy]) and during the later years of the planning period (greater than 60,000 tpy.) These same approaches could be further applied to accommodate any or all of the potential quantities from other jurisdictions suggested in Table II-2 during any year or years of the planning period.

### **III. ASSESSMENT OF AREA MRFs**

As part of the Feasibility Study, a visit was conducted at each of three major private companies that own and operate MRFs in the region. The visits had two objectives:

- Observe and discuss with the operator the processing operation
- Discuss with the operator capabilities and interests for providing MRF services to the City of Tucson

Visits were made on three successive days, August 12 through 14, 2008. Participating personnel included:

- John Roderique, P.E., GBB
- Romy Suba, Sr. Process Engineer, RRT
- Andy Quigley, Director, Environmental Services Department
- Don Gibson, K.G.F.E., Recycling Coordinator, Environmental Services Department

From these visits, important conclusions were developed regarding the prospect of each of these companies to provide future MRF services for the City of Tucson.

It is important to note that one of the three companies, Hudson-Baylor Corporation, does not have any business operations in Tucson. Related to that is the prospect of other private companies that do not have recycling operations in Tucson to take an interest in providing MRF services to Tucson.

The GBB/RRT consulting team is aware of other companies that have recycling operations elsewhere and would potentially be interested in and have adequate capability to construct a facility and provide MRF services for the City of Tucson. To identify and provide a comprehensive assessment of all such companies was beyond the scope of this study. However, in general, other companies would have certain similarities in financial, technical, and marketing capability to Hudson-Baylor Corporation. Thus, Hudson-Baylor Corporation is a good representative of this type of company, filling the need to assess that type of processor for this feasibility study.

#### **A. Waste Management Recycle America (WMRA), Tucson**

On August 12, 2008 the project team visited the WMRA MRF on Runway Drive in Tucson to observe the current operation and conduct a visual evaluation of the processing system. Following the tour of the facility, a discussion was held in the company's meeting room. Observations and results of the meeting by the project team are presented in this subsection. Company contact information for those personnel hosting the visit is as follows:

**Michael R. Timpane**  
Senior Project Manager –  
Municipal Segment  
317 Sawmill Lane  
Ponte Vedra Beach, FL 32082  
Office: 904-718-5624  
Cell: 904-524-1134  
[mtimpane@wm.com](mailto:mtimpane@wm.com)

**Ed Berry**  
Plant Manager  
Recycle America  
3909 North Runway Drive  
Tucson, Arizona 85705  
Phone: 520-292-2900, X212  
Fax: 520-292-1504  
Cell: 520-631-9067  
[eberry@wm.com](mailto:eberry@wm.com)

**Carrie Galvan**  
District Manager  
Recycle America  
7025 N. Scottsdale Road, Suite 200  
Scottsdale, Arizona 85253  
Phone: 623-256-1880  
[Cgalvan1@wm.com](mailto:Cgalvan1@wm.com)



Aerial photo of Recycle America - Tucson

WMRA is an operating unit of Waste Management, Inc., (WMI), a New York Stock Exchange company and the largest waste management service provider in North America. WMI's revenues and after-tax profits in 2007 were more than \$13 billion and \$1 billion, respectively. WMRA operates nearly 100 MRFs nationwide, including recently constructed facilities that have process systems designed for single-stream processing.

This facility receives an average of nearly 180 tons of single-stream recyclables each work day. The facility also receives an undisclosed amount of recyclable materials from other sources, primarily paper from commercial customers. The site is surrounded by a combination of industrial businesses and residences. The administration building is a two story pre-fabricated structure with metal siding. Attached to the administration building is a long narrow rectangular building open on one side. Half of the open building houses the tipping floor and in-ground feed conveyor and the other half is used as a paper baling operation.

The site perimeter is secured with an approximately 12 feet high chain link fence with the lower section covered from outside view. This MRF does not have public drop-off or buyback.

The tipping building appears to be significantly undersized, evidenced by the large pile of recyclable material extending outside to the open yard. While the company may process on a daily basis a quantity that approximates deliveries of that day, a buildup of material from prior days and weeks remains at the end of each day. This stockpile of material is purposely left on the tipping floor each workday, providing quantities to operate the MRF, from startup at 6:00 a.m. until collection trucks begin to arrive with loads at approximately

9:00 am each workday. This is a common practice among MRFs. The second wave of material delivery occurs at 2:30 p.m. each day.

The process system is comprised of a series of in-feed, transfer and sort belt conveyors, star shaped disc screens, overhead magnet, a light density air separator, an eddy current separator (ECS) and two balers. The overall physical condition of the process equipment appears to be beyond the mid-point of the designed service life. It is estimated that within three to five years from the visit date a major refurbishing will be in order. The two-ram baler however, shows significant wear, and it will likely require major parts replacement in the near future. WMRA is cognizant of the condition of the two-ram baler and is in the process of procuring a Harris "Centurion" model baler to replace it.

WMRA is committed to add the latest technological equipment such as optical sorting equipment to enhance material recovery if the City of Tucson will require so. WMRA has replaced stars in the star screens with different sizes to experiment with separation effectiveness and has replaced major pieces of equipment in addition to conducting normal maintenance and repair on an ongoing basis. When the facility has been out of service, WMRA transports material delivered by the City to other WMRA facilities.

A total of 30 sorters were observed performing various sorting duties for the entire process system in the day of the visit. Loader operators, mechanics and supervisors are not included in sorter counts.

Ten grades of materials are recovered at the WMRA Tucson single-stream facility:

- Old corrugated cardboard (OCC)
- Grade No. 7 old newspapers (ONP)
- Mixed paper
- PET (No. 1)
- HDPE (No. 2)
- Aluminum beverage cans
- Tin-plated steel food cans
- Flint glass
- Amber glass
- Mixed 3/8" glass aggregate

The process equipment was manufactured by Machinex, one of the major national suppliers of this type of equipment, and installed in this facility in 1992. The process system has a 180 degree turn around, resulting in the second "half" of the main process line being stacked vertically above the first half. This stacking approach results in equipment in a relatively small volume of space, a "tight" arrangement that would likely restrict modifications that require adding in-line elements to the system. Other sections of discharge conveyors are oriented 90 degrees from the main process line, a common layout feature. This approach to system layout resulted from the small amount of land available at this site. Conveyors discharge to the baling operations; the MRF has two horizontal balers, with one scheduled for replacement during the third quarter 2008. The processing system is installed in the open yard, however sort stations are provided with roof covers.

Due to a portion of the process system being at a high elevation (the stacked portion), in combination with the entire system located outdoors, paper and plastic film material is blown off the property to the surrounding road and properties. This occurs on a continuous basis and is especially bad on windy days. To mitigate this littering issue with neighboring

industrial businesses and the residential community, WMRA designates one person to perform clean-up outside the facility each work day on essentially a full-time basis.

Once placed on the conveyor by the wheeled bucket loader, the material is subjected to the first step in processing, termed pre-sort. Pre-sort refers to a sorting activity prior to the materials reaching the automated and manual process equipment. For the pre-sort, sorting stations are located on each side on the conveyor belt just downstream but physically separated from the in-feed portion of the conveyor. Two chutes are typically installed on each side but only one person works on each side to remove trash and plastic films. (This configuration can be duplicated to have additional pairs of workers and chutes for higher processing rates [tons per hour]). At the WMRA facility, the conveyor appears to run faster than the normal setting, indicating that the system is running at peak capacity.

The post-old corrugated container (corrugated or OCC) fiber and container stream splits into three parallel sorting lines in order to attain a workable material burden depth for effective manual picking of various grades of paper. This is one of five star screen conveyors in the facility used to remove containers from paper.

Workers manually remove PET (polyethylene terephthalate, or Number 1), HDPE (high density polyethylene, or No. 2), flint (clear) glass, and brown glass on the mezzanine container sort line and toss them to chutes where they fall into bunkers below. Tin cans are removed by an overhead magnet prior to the container sort line. Aluminum cans are removed by the ECS at the end of the container line.

The WMRA MRF runs on a single nine-hour shift, six days per week. The process system is designed to handle 22 tph of single-stream material. On this basis, on days the facility receives 150 tons, it is running at 76 percent of its rated capacity. The facility can process greater quantities by operating for more than nine hours each day, if needed. However, daily receipts will increase to nearly 180 tons per day when the City switches from six- to five-day-per-week collection in November 2008. Residue requiring landfill disposal runs in the range of 12 to 13 percent of incoming quantities. This is a reasonable residue rate for single-stream although lower residue rates have been achieved. According to ES staff, delivered quantities average nearly 150 tons per day on a six-day-per-week basis. Although the City has neighborhoods that set out grades of paper and containers, some neighborhoods set out almost exclusively containers and no paper and some neighborhoods set out nearly all paper and no containers. However, due to the large overall quantities, materials with these unusual proportions are sufficiently mixed in the MRF so as not cause performance problems with sorting operations.

City collection trucks and trucks delivering materials from WMRA and other WMRA customers queuing is a maximum of ten minutes. However, due to the small site, during peak truck arrival periods, as many as six trucks queue on the City street (North Runway). Processed material is delivered to markets using trucks; rail is not available.

During discussions with WMRA, WMRA indicated it is not in a position to add other metals to the curbside collection program as the process system could not handle it. Another material discussed, expanded polystyrene (EPS), or coffee cup/package material, if added to the program, could only be marketed with mixed plastics. For now, WMRA is of the opinion that EPS is not an attractive material to add. Plastics numbered 3 through 7 form the mixed plastics that are marketed without further separation. Overseas markets have been purchasing these mixed plastics in the last year or so. However, WMRA believes that the

markets pick out grades of plastic they will used, such that perhaps only 70 percent or so of the bales of mixed 3 through 7 plastics are recycled.

WMRA expressed a willingness to GBB to make a capital investment in the facility should the City desire to add materials to the recycling program that would require a revision in processing capability. However, at this time WMRA has not made any such proposal to the City. This facility has an attractive location as it is reasonably close to a large portion of City collection routes, those in the northern half of the City. Beginning in 2008, WMRA commenced planning efforts for constructing a roof over the facility; however, this initiative has not been approved for implementation.

WMRA officials discussed plans to remodel and equip the current meeting room with a large screen plasma TV for video cameras monitoring. Also, the meeting room could be used to conduct educational programs and a virtual tour of the facility for City of Tucson students and residents. These improvements have not yet been implemented, but are planned for implementation prior to the end of 2008. An educational room would make a contribution to the overall education and information program.

The current contract (the 2002 contract) between the City of Tucson and WMRA includes payment by the City of fixed payment or tipping fee of \$16.31 per ton with a 50/50 split in revenues. With material prices high, the City receives payment that total nearly \$2 million per year in fiscal year 2008, in comparison to the City paying WMRA approximately \$752,000 per year in tipping fees. The tipping fee for 2002, the first year of the contract, was \$11.00 per ton. Net revenue WMRA has paid to the City has ranged from \$14.37 per ton in early CY2003 to \$56.87 per ton in July 2008, reflecting the steady increase in paper prices and increases in 2008 for metals. The history of the tipping fees, revenue sharing and net revenue is presented in Table III-1.

**Table III-1 - Historical Revenues and Fees**

FY	Tons Del'd to MRF	Tipping Fee Paid (000s)	Revenue Sharing (000s)	Net Received (per Ton)
2003	33,921	\$553	\$270	\$ 8.35
2004	46,489	\$758	\$1,227	\$10.09
2005	47,608	\$776	\$1,432	\$13.78
2006	46,034	\$751	\$1,382	\$13.70
2007	46,918	\$765	\$1,756	\$21.12
2008	46,090	\$752	\$2,252	\$32.55

Source: Data provided by City of Tucson.

WMRA also expressed to GBB a willingness to forego the tipping fee and structure the compensation with just a payment by WMRA based on a revenue share. The company expressed a willingness to be flexible on revenue sharing amounts, although the company is not willing to accept all material market risk. WRMA wants contractual terms to reasonably mitigate those risks.

Acreeage to expand the site next door is likely not available, such that constructing a process system layout that would all be at one level, as opposed to the stacked layout, and possibly fully enclosing the building, is not feasible.

As a matter of reference, the distance from this facility to the City's truck maintenance facility at 4002 South Park Avenue, where City collection trucks return for overnight storage, is approximately 10 miles. Select photographs taken during the visit appear below for reference.



Recycle America tip floor



Recycle America in-feed conveyor and baled products for baler



Recycle America in-feed conveyor for two-ram baler

## B. Friedman Recycling Co., Phoenix

On August 13, 2008, the project team visited the Friedman Recycling Facility in Phoenix. Company contact information for those personnel hosting the visit is as follows:

### Morris Friedman

Vice President  
3640 West Lincoln Street  
Phoenix, AZ 85009  
Phone: 602-269-7521  
[MorrisFriedman@FriedmanRecycling.com](mailto:MorrisFriedman@FriedmanRecycling.com)

### David Friedman

Vice President  
(Address and phone: same as above)  
[DavidFriedman@FriedmanRecycling.com](mailto:DavidFriedman@FriedmanRecycling.com)

The Friedman brothers, David and Morris, company vice presidents, accompanied the team for a tour through their processing operation. Following the tour, a discussion was held in the company's meeting room. Friedman's Phoenix facility has a sorting and baling operation, however, it exclusively serves commercial customers. Since April 2007, the company has operated a single-stream municipal recycling MRF in El Paso, Texas, so the meeting included a presentation about that facility. Observations and results of the meeting by the project team follow.



Friedman Recycling MRF, El Paso, TX

### 1. Friedman, Phoenix MRF

The administration and scaling facilities are all integrated into one area housed by interconnected pre-fabricated modular buildings. The office environment was quiet and clean.

The facility sits on a 10-acre property surrounded by commercial, industrial and residential neighborhoods. The site perimeter is secured with approximately 16 feet high fencing with the lower half section covered with corrugated metal panels to conceal plant activity from public view. The plant has one scale servicing inbound and outbound traffic.

The system is comprised of two independent sorting lines equipped solely with Bollegraaf equipment. Between the two sort lines, plastic film, high grade fiber, OCC, ONP, mixed paper, PET, HDPE and aluminum are sorted out. However, grades of paper were predominant in piles on the ground adjacent to the in-feed conveyor; few containers were present in the feed stream.

Material is processed with high efficiency in an in-line flow from the scale through the process lines and baling operation. Baled material is stacked in outdoor areas near the baler and then loaded into trailers that are staged at an outdoor loading dock. The company has a second exit near this end of the site so that truck-trailer combinations loaded with baled material can leave the property without driving back through the site.

The entire operation is located outdoors and only the sort stations have roof covers. Since all materials are stored in open space, it is operational policy to maintain a clean area after processing hours. To accomplish this policy, the company processes all incoming material each day so that no material is left on the tipping area at the close of each business day.

The Friedman Phoenix facility, in its existing configuration, is not capable of processing single-stream material. However, the site appears to have adequate acreage to revise the existing processing system to provide equipment to accommodate single-stream materials.



View of yard



In-feed conveyor and baler



Loading dock

As a private company, Friedman Recycling does not release its financial data. The company is family-owned, has been in business for 31 years, and is operated by second generation family members. The company is one of the largest private recycling companies in the southwestern U.S. The company's MRF in El Paso, Texas, described in this subsection, required a \$5.5 million capital investment. Capital financing for the entire investment was provided by the company. The company stated that it has financing capabilities in place to implement two to four additional MRFs to serve other municipalities, including Tucson.

## 2. El Paso, Texas MRF

After the facility tour, Friedman Recycling gave a presentation of the new El Paso facility to demonstrate their willingness and technical capability to process the Tucson recyclables in a new MRF. This MRF commenced commercial operation in the second quarter 2007. The Texas facility has a single-stream processing system entirely equipped with Bollegraaf equipment with associated sort platforms and storage bunkers. The facility has one Bollegraaf 110C single ram baler.

El Paso's residential curbside program includes an array of material similar to that in Tucson, except for glass containers, an uncommon exclusion. Glass containers are a challenge for a recycling program as they break at several stages during handling. A portion of glass containers break during each step in handling. Broken glass is abrasive to conveyors and other sorting equipment, so that their absence will reduce the maintenance and repair requirements on the El Paso MRF compared to MRFs processing glass containers.

The company acquired a site with rail siding so that baled materials can be shipped by truck or rail. The facility is constructed on a nine-acre property with room for expansion for a redundant system. An outside loading dock has space to load four trailers at a time. The MRF does not provide for public drop-off of recyclables.

All material receiving and processing is conducted within a 45,000 square foot rectangular shaped pre-engineered building with no interior dividing walls. Certain structural components were omitted from the back end wall of the building (wall with closeable doors) through which forklifts carrying completed bales travel through to exit the building. The purpose of this is to allow expansion of the building to increase its capacity at some future date. This design feature, sometimes termed "provisions for" future revision, is especially useful when expansion is desired. The first benefit is that allowance was provided on the site for expanding the building without encroaching on other site activities such as truck maneuvering. Another benefit is that construction costs will be more economical due to the features specifically chosen to accommodate future expansions.

The facility has one scale and a scale house next to the scale. Incoming material is delivered through the four-bay tipping hall and stockpiled in the middle of the floor as perimeter walls are not designed to support material storage (no pushwalls). The tipping floor is approximately 15,000 square feet of floor area and is capable of storing two days delivery of material.

In-feed material is metered by a rotating drum placed at the end of the pit (below-grade) in-feed conveyor. The in-feed conveyor transitions to the pre-sort line, where three sets of manual pre-sort stations, staffed by six sorters, remove bulky materials, scrap metals and OCC. Further processing consists of feed, transfer and sorting conveyors, as well as automated equipment including three screens, a magnet and eddy current separators.

In addition to the automated processing, this MRF also includes manual sorting downstream of the pre-sort to remove unacceptable materials, leaving ONP and mixed paper to fall off of the end of the sorting conveyors. This processing approach is commonly termed a negative sort. Friedman's contract with the City calls for residue rates to be maintained at or below the pilot program levels of 18 percent of total quantities.

Friedman plans an additional \$2 million investment in the El Paso MRF. Plans for these funds include:

- Audio communication and cameras on each side of the scale so that the scale house will not require staffing
- Expansion of processing building
- An optical sorting system to separate PET and HDPE

- Additional automated sorting screens to increase facility throughput beyond the rate manual sorting can accomplish

The system is designed to process 200 tpd in one and a half extended shifts; the company receives 125 to 150 tons per day from 170,000 households in the program. The company has a ten-hour full shift followed by a 5-hour short shift five days per week and a single shortened shift on Saturday. Staffing is 30 sorters for the full shift and 20 for the short shift.

The land and facility is wholly owned by Friedman Recycling Company. Friedman's contract with the City of El Paso extends for 15 years from the 2007 in-service date. The City of El Paso pays no fees to Friedman Recycling. The contract specifies that Friedman will pay the City 50 percent of revenues realized for all materials up to a specified annual quantity amount and 10 percent for materials above that quantity each year. As the company does not operate other MRFs nearby, the company has a need to store material on the tipping floor during system outages. It would not be economical to ship material to the company's Phoenix facility, as the two are more than 430 miles apart by highway, and in addition, the company's Phoenix facility is not set up to ordinarily process single-stream recyclables.

In 2007, the company was selected by the City in a procurement process to provide recycling services for City government facilities. Also, after discontinuing commercial recycling services, the City government has requested Friedman to ensure that recycling services were available to any commercial organization within the City that desired service. Friedman has affirmatively responded to that request and is conducting sales and marketing in this sector. In 2008, Friedman has begun to market its capability to commercial generators of recyclable materials in El Paso.

Friedman has indicated its capability to implement a MRF in Tucson on an expedited schedule. The company believes that 90 days would be sufficient time to respond to a City-issued RFP, including identifying and obtaining a commitment for purchase or leasing a suitable site. Further, the company indicates that 18 months from the time of submittal of a proposal to startup of the MRF would be sufficient, provided the City is able to also execute an expedited selection and contract development process so that Friedman could provide services to the City beginning July 1, 2010.

### **C. Hudson Baylor Corporation, Scottsdale**

Hudson Baylor Corporation is based in Newburgh, New York. The company was founded in 1983 when a member of a family-owned beverage company implemented a processing facility to respond to New York State's bottle bill enacted that year. In 2008, the company operates a total of ten processing facilities, half of which are municipal MRFs, three of which are in the Phoenix area. The other five facilities process containers from bottle bill deposit and return operations in the northeast U.S.

On August 14, the GBB team visited the Hudson Baylor Salt River MRF. The facility is located on the Salt River Landfill site, 13602 North Beeline Highway (AZ 87), Scottsdale, an active landfill owned by the Salt River Pima-Maricopa Indian Community. The MRF is sited on a two-acre property. The GBB team made observations of the Hudson Baylor MRF operation that are presented in this subsection.

Company contact information for those personnel hosting the visit is as follows:

**Tommy Van Tassel**

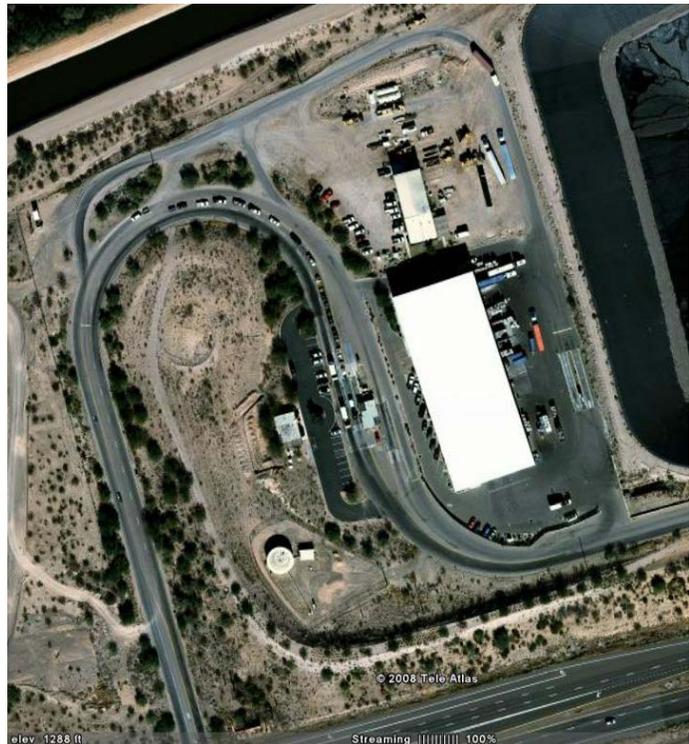
Area Plant Manager  
River Recycling LLC  
Salt River Landfill MRF  
13602 E. Beeline Highway  
Scottsdale, Arizona 85256  
Phone: 480-850-1224  
Fax: 480-850-1323  
[tvantassel@hudsonbaylor.com](mailto:tvantassel@hudsonbaylor.com)

Mail address:

P.O. Box 15067  
Mesa, Arizona 85211-5067

**William J. Herzog**

Business Development  
237 Dupont Avenue  
P.O. Box 947  
Newburgh, NY 12551-0947  
[wherzog@hudsonbaylor.com](mailto:wherzog@hudsonbaylor.com)  
[www.hudsonbaylor.com](http://www.hudsonbaylor.com)



Hudson Baylor - Salt River MRF, Scottsdale, AZ

The MRF commenced operation in January, 2002 and currently processes approximately 85,000 tpy of material on two eight-hour shifts each operating day, at average rates that exceed 325 tpd or 20 tph.

The process system consists of conveyors and screens manufactured by Machinex and two balers supplied by Bollegraaf, an HBC 110 and HBC 80. In 2008, the company installed three TiTech optical sorting equipment in the process system to increase recovery efficiency and quality of recovered material. These optical sorters have allowed facility personnel to be reduced by eight sorters per shift.

No other technological changes have been implemented at the facility. The overall physical appearance of the conveyors, screens and balers appeared to be appropriate for this application. It is estimated that the equipment can sustain another five to seven years of current operation before major refurbishing will become necessary.

The tipping hall has pushwalls one each side, approximately ten feet high, with extensions of approximately three to four feet, thereby allowing material to be pushed into tall piles. Hudson Baylor representatives indicated that the tipping floor is capable of storing material from two days of collection. However, from observations the tipping floor appears too small to hold that capacity, more than 600 tons. MRF operations personnel keep the piles in an orderly fashion and maintain a clean tipping floor to allow two shifts of materials, more than 300 tons, to be received during the first shift. The City of Scottsdale delivers material in 110 cubic yard transfer trailers, approximately six loads per day.

Material loaded onto the in-ground in-feed conveyor is transported first to the pre-sort station, equipped with two chutes and staffed by one sorter on each side of the conveyor to manually pick bulky non-recyclable materials. The Salt River MRF employs 21 sorters plus maintenance and mobile equipment operators per shift.

Company personnel estimated residue to be less than 20 percent of material throughput. Due to the high quantity of recyclables in the residue, these materials are taken from the discharge area of the process system to the tipping floor for "looping" back into the system to recover missed recyclables.

The facility has two scales and reports having not more than two trucks waiting to weigh at any time, thus avoiding truck queuing issue. The company's small site provides a strong incentive for an efficient truck scale operation as the facility has little available truck queuing capacity.

The MRF produces grade No. 7 newspaper, mill ready, as set by the current market condition. This is common among MRF operations. Nos. 3 through 7 plastics were not in the original scope of recoverable items and neither are they included in program instructions provided to residents. However, residents are placing significant quantities of these materials in their set-outs. Hudson Baylor has accepted these plastics as the company has found a market for these materials. Also, the MRF was not designed to handle these plastics but is successfully processing them. However, it should be noted that a significant portion of these No. 3 through 7 plastics are large items, such as five gallon buckets, two-gallon or larger water containers, and other containers that are larger than the original processing system was designed to handle. The facility is not designed to handle plastic bags or large metal items, again due the processing line not being designed to handle it. Company representatives indicated that batteries and e-waste should not be part of the recycling collection system for processing at their MRFs.

Corporate personnel develop relationships with material markets, but day to day sales decisions are made by personnel based at the MRFs. Among markets used, the company has used Strategic Materials, Inc. (SMI) for glass; shipments are made to SMI's facility in Mexico.

The Salt River Landfill owner has a site plan that maximizes the amount of land dedicated to landfill cells. However, this left a relatively narrow rectangular portion of land between the western perimeter of one landfill cell on the western portion of the property. Although the owner was willing to allow Hudson Baylor Corporation to construct a MRF on this land, the result was a plot that required certain special design and operational approaches:

- Loading dock sizing is limited to two truck bays
- Limited outside material storage capacity, resulting in a need to load trucks with outgoing baled product each day, most if not all of the prior day's processing
- Limited tipping floor
- Limited process area, resulting in a "stacked" process system that would likely result in greater cost for certain revisions to the system, should they be needed in the future

The company also owns another MRF in the Phoenix area and operates a third MRF under contract with the City of Phoenix. The Phoenix MRF is owned by the City. When the Salt River MRF experiences outages, the company transports material to one of these other two facilities in Phoenix for processing.

The company has a revenue sharing arrangement with the Cities of Scottsdale, Mesa, and Gilbert. The contract with Scottsdale is ten years plus one or more extensions beyond ten years. Hudson Baylor would want a contract of about ten years to justify the investment in a new MRF in Tucson.

The company expressed an interest in developing a MRF in Tucson to serve the City and indicated that they would respond to an RFP issued by the City. Further, the company would be amenable to developing a MRF at the City's Los Reales Landfill site. Hudson Baylor does not have any recycling operations in Tucson. The company indicated that a desirable site in Tucson would be a minimum four to five acres. Regarding using one or more of the company's existing facilities in the Phoenix area to process materials collected in Tucson, company representatives indicated they were open to this alternative, even though the company is planning to implement another MRF in the Phoenix area in the future.

The company understood that a program to transfer haul Tucson's materials to Phoenix would require implementing a transfer station to load material onto transfer trailers for transportation to Phoenix, since the City of Tucson does not currently have a transfer station that could be used for this purpose. The company would likely not pursue other business in Tucson, as the company's focus is on processing, and does not offer collection services in any of the communities in which it operates processing facilities.

As a matter of reference, the distance from this facility to the City's truck maintenance facility at 4002 South Park Avenue is approximately 116 miles. Photographs of equipment and the facility are not available as photography was not permitted during the visit.

## **IV. MRF FEASIBILITY**

In this section, key issues in four decision areas necessary for providing MRF services for the City of Tucson are identified and discussed.

The first discussion area is the approach taken for ownership and operation of a MRF, including ownership of the site. The second area is siting needs for a MRF to be built to process the City's materials. The third area is consideration of additional materials to be processed by the MRF. The fourth area provides estimated capital and operating costs for a MRF that would be adequate to serve the City's needs and life-cycle projections for it as well.

### **A. Ownership and Operation Alternatives**

Four alternatives for ownership and operations are considered in this subsection:

1. Contractor Built/City Operated, City-owned property
2. Contractor Designed and Built/Contractor Operated, City-owned property
3. Contractor Built/Contractor Operated, Contractor Owned or Leased Property
4. Transfer Materials to existing Phoenix area MRF for Processing and Marketing

Each alternative is discussed in the following paragraphs. For City-owned alternatives, the MRF would need to meet LEED Silver standards as well.

#### **1. Contractor-built/City-operated, City-owned Property**

In this alternative, a contractor would construct a MRF at the City-owned Los Reales Landfill site. At the conclusion of all construction activities and after a successful acceptance test, the contractor would turn the MRF over to the City and the City would staff it and operate it. The City, with the assistance of the Contractor, would recruit and train facility operational personnel during the construction period so that adequate facility staff could operate it as soon as it was available for commercial operation. Since the MRF would have a large amount of stationary and mobile equipment, the contract would include requirements for the contractor to provide training at another facility the contractor built and operated or had access to for training purposes. Another contractor requirement would be to conduct an operational acceptance test of the new MRF.

The City would bear management and marketing responsibility. MRF operations general management would be a responsibility of ES and would require an incremental increase in management resources to deal with operational and planning issues, similar to that required by other ES operating activities. Separately, the City would be responsible for obtaining and managing relationships with materials markets. Shipments would occur each processing day, and with nearly 1,000 tons or 50 truckloads to market each week, this would be a full-time position, whether the City markets to brokers, end users (mills), or a combination of both.

The approach in this alternative is the same used by local governments for process facilities traditionally owned and operated by local governments.

The City could use either of two traditional methods to have a MRF constructed in this alternative. The following discussion presents these methods in a summary fashion.

A&E - Under this method, the city owner would hire an architectural/engineering (A&E) firm to develop all architectural design and engineering for the building and process system, and to specify mobile equipment. The A&E's product is a set of plans and specifications as well as permits needed from government agencies. Plans would detail each constructed feature, such that the construction contractor would not have any influence on the process design, neither would the contractor revise it during construction.

Plans and specifications would be attached to a standard construction contract and advertised for bidding by construction firms to construct the facility and purchase mobile equipment. The lowest qualified bidder will be awarded the contract. The City or its A&E firm would be responsible to provide construction monitoring to ensure that construction conforms to the plans and specifications. This implementation approach is common for non-process related facilities, including office buildings and schools. Most road procurements follow this method. Local governments also use the A&E approach for wastewater processing and potable water processing facilities as the local government sponsor usually intends to operate these facilities.

An advantage of this approach is that the City would maintain control of the entire design and construction process. A disadvantage is that process design of MRFs remains quite dynamic, having to react to revisions such as the switch to single stream in the current decade, changing the mix and quantity of materials as programs change for greater diversion, and introduction of new process technology. Thus, technology-oriented success of the MRF would be dependent upon the city hiring an A&E firm that has adequate specialized expertise to select an up-to-date process design and provide flexibility to easily revise the process in the future. An additional disadvantage is that, once the facility is completed, the City would accept the risk that the facility will work and only has the A&E to share that risk.

Turnkey – Under this method, the City or its consultant documents the functional requirements for a facility. An example of functional requirements might include "...a materials recovery facility that is capable of processing 250 tons of recyclable materials in eight hours, providing on-site storage for up to five days of processed material". These functional requirements are provided in significant detail in a request for proposal (RFP) document that would be advertised to the contractor community.

In the turnkey alternative, the RFP would require the selected contractor to provide all design and engineering, equipment, construction and acceptance testing, in one contract. Turnkey proposals would allow the City to review the technical approach proposed to fulfill the functional requirements, evaluate these against the cost of each proposed approach, and decide which is the most cost effective. The contractor selected would conduct all of these activities. The City would not engage an A&E firm to prepare the design and permitting. Unlike the A&E approach in which any construction contractor with capability to construct a facility the size of the MRF could propose, in a turnkey procurement, the City could expect that proposing contractors would be restricted to those that have experience in

designing MRFs. Contractors may take on partners that have process system expertise, perhaps even a process equipment manufacturer.

After mechanical completion is reached in construction, the turnkey contractor would conduct an acceptance test to demonstrate to the City that the MRF meets the specifications. Thus, the primary difference of the turnkey approach to the A&E approach is that the contractor adds to his scope the design of the facility and conduct of an acceptance test. This shifts the technical risk to the contractor(s) chosen for this specific expertise.

An advantage of the turnkey approach is that the City would shift most control but also responsibility for design and construction of the MRF to the contractor. Offsetting this advantage for the turnkey approach is the lack of control over a facility for which the City would have to live with for its operational life and the lack of flexibility in design, expected due to the need for contractors to offer competitive prices.

For either the A&E or the turnkey procurement approach, a long-term advantage for the City would be the control the City would have over operation of the MRF, highlighted by the fact that it would need to be sited on land owned by the City. Offsetting this advantage is City responsibility for maintenance and repair, for accepting technology risks post acceptance testing, and for providing capital funding for facility major repair and for upgrades to respond to changing technology needs.

MRF technology has changed significantly over the past several years to accommodate materials being added to recycling programs, to add automation for operational cost reduction, and to improve the separation of materials. As discussed in Section III, the GBB Team believes that technology will continue to change for MRFs during the planning period of this Feasibility Study. However, changes are not expected to be of a fundamental nature like those experienced as the industry moved from first and second generation systems implemented 15 to 20 years ago to today. Knowledge gained from those legacy systems have resulted in third generation systems that respond to recycling program changes and offer flexibility to respond to future changes.

One of the most important risks associated with ownership and operation of a MRF is the processing system failure. MRF systems, consisting of conveyors, magnets, air separation systems, computer-controlled optical sorting systems, manual sorting stations, balers, wheeled bucket loaders, forklifts, and other equipment, present a complexity not generally found in any other facility operated by City government. Thus, entering the MRF operation business means that several management systems must be developed and executed to support these specialized pieces of equipment and systems, including, but not limited to, safety (regarding processing system), production, maintenance and repair, risk management (insurance), product marketing, and other systems. While the City has certain systems in place that could be used, such as human resources, a management structure, general safety training, and perhaps others, the majority of systems fall into the "new" category, posing a learning curve on the city and requirements for ongoing stand-alone resources specific to the MRF.

A MRF is a material handling facility, with its technology initially borrowed from several other manufacturing industries. Like these other industries, scale economies gained by operating multiple facilities to spread costs for developing and maintaining expertise needed for operations, maintenance, product marketing, and others, help make these operations

successful. In the current generation, private companies have developed equipment and systems specifically designed for waste materials, as well as relationships with product purchasers. The three private companies described in Section III of this report each operate multiple MRFs and each has systems already developed that the City would face developing on its own under this alternative.

#### Los Reales Landfill Site for City-owned Site

On August 12, 2008, GBB team members (Roderique and Suba) visited the Los Reales landfill site, located next to Los Reales Road and Craycroft Road, approximately one mile from I-10 in the southwest quadrant of the City. The site is owned and operated by the City of Tucson and includes an active landfill. A City landfill supervisor took the GBB/RRT personnel for a tour of the site to assess the layout and planned construction. The Landfill was the subject of a Planned Area Development (PAD) study produced in 2006. The study outlines basic features of the site such as road network, topographic and geologic characteristics, zoning, and other items that help identify capability and limitations of the site.

The landfill site is comprised of 1,087 acres located near a few industrial business properties and two small residential developments. The site includes approximately 423 acres proposed for landfill cells and 80 acres on the north side of Los Reales Road. In 2008, the City is constructing a cell to be used after the current cell reaches permitted capacity. The site operates two scales with a scale house, one for inbound and one for outbound traffic.

The 80 acres on the north side of Los Reales road has been identified as a potential location for a MRF. A topographic map of the site is presented here as Figure IV-1. The 80-acre site fronts on Los Reales Road directly north of the landfill. To the west of the site are other private businesses, and the eastern edge of the site fronts on Craycroft Road. A development of single-family homes abuts the northern end of this site. The overall acreage here would ensure that adequate buffering of the MRF to the housing could be provided.

The City does not have a truck storage lot or a maintenance garage at the Los Reales site and does not have plans to implement either at the site. As a practical matter, it is desirable to minimize the travel distance of the route collection trucks when off-route and after the trucks have tipped their last load at the MRF. Minimizing this end-of-day travel distance, helps to minimize costs, including fuel, labor, and other operational and maintenance costs of the trucks. Efficient routing also reduces emissions and traffic.



## **2. Contractor-designed, Contractor-built, Contractor-operated/City-owned Property**

In this alternative, like the turnkey procurement approach, the City would document the functional requirements for the MRF in an RFP document to be offered to the contractor community. Similarly, the selected contractor would construct the MRF at the Los Reales Landfill site and provide capital financing and own (the building, process equipment, and mobile equipment) and operate the MRF. For private ownership, the contractor would enter into a long-term lease of a term at least as long as the Service Agreement with the City for the MRF site. The City would retain ownership of the site during the contract and after the contract expires, providing a degree of control over the MRF. The contract would provide for the disposition of the facility at the end of the contract. This approach has been used for numerous other waste processing facilities in the U.S. and is commonly known as the full service approach.

The full service method is an extension of the turnkey method. Because of the specialized nature of the facility or for other reasons, the City would add to the turnkey method the requirement that the contractor would also operate the facility for the initial operating period, although this period could be ten years or longer.

In this alternative, proposals submitted to the City would include the capital cost of providing the facility and the annual operating and maintenance costs for the quantities of material the City indicates that it would deliver to the MRF. Economics of the MRF would depend on materials markets. Repayment of interest and principal on debt financing along with a return desired by the contractor on an equity contribution made, as well as the operation and maintenance costs would be offset by revenue provided by materials sold to various markets. Depending on prices being paid by materials markets, the net economics could be that costs exceed revenue or the opposite could be true. In 2008, prices paid for materials are high compared to historical rates, resulting in significant revenue over and above costs. Economic formulas can be applied for a long term full service contract that takes into account changing materials price levels, for a degree of risk allocation among the contractor and the City selected during RFP development.

The site lease could be structured in at least two ways. One approach is that it could be renewed for one or more periods of time after the contract to provide processing and marketing services to the City expires. This would allow the contractor to continue operating the MRF, soliciting business from other customers. At the time that the contractor ceased providing services to the City, the City would either have to provide another site for a different contractor, use a contractor that had a site with a new or existing MRF, or contract for City construction of a new MRF (as in Alternative 1).

A second approach would be that the contractor be required to remove equipment from the building upon the expiration date of the service contract and sell the empty building to the City. The City could potentially use the building for another purpose.

An advantage of this approach is that the implementation process for a contractor under a new contract would avoid the difficulties of obtaining a site for a MRF. Although the contractor would be responsible for locating a site that meets zoning and community acceptance, such a site acquisition process can oftentimes be problematic and possibly hold up construction of the MRF beyond the needed date. So, if the City provides a site, this problem is avoided in the implementation process. Difficulties contractors have in siting a

solid waste or recycling facility has been a primary reason for cities and counties to provide sites for MRFs and other related facilities.

A disadvantage is that the site becomes committed to the selected contractor. Also, it is difficult to predict with certainty the desirability of having the contractor on a City-owned site but without any other contractual relationship with the City. The City would have expectations for general exterior housekeeping, litter and dust, and other items that the contractor may not meet, and the City might possibly have difficulties enforcing them using just the terms of the site lease. Also, should the contractor have financial difficulties, the contractor could possibly allow aspects such as housekeeping to deteriorate or as a worse case, abandon the building, leaving equipment and material for the City to take responsibility. To avert these problems, the City could consider being the owner of the MRF while still contracting with one private party for design, construction, acceptance, operation and maintenance, and product marketing services.

### **3. Contractor-built, Contractor-operated, Contractor-controlled Property**

In this alternative, the City would prepare and issue an RFP similar to the second alternative, but without site information. Instead, the contractor would be responsible for acquiring a site. In addition, the City would not have a basis for acquiring the MRF at the end of the term of the service contract, although such an arrangement would not be precluded; it would necessarily involve acquiring the site through purchase or lease.

The contractor would operate the MRF under a contract specifying a full service arrangement, as previously discussed. The City's arrangement with WMRA that commenced in 2002 conforms to this alternative. WMRA has legal rights to its site located in the City and it owns the MRF. WMRA also is responsible for all operating and maintenance costs, product marketing, as well as for upgrading the facility to meet revisions to the recycling program.

This alternative avoids the limitations posed by a City-owned site. Should the private contractor desire to add quantities and types of materials to the MRF, the contractor would have more flexibility on a site the contractor controls. Additional quantities and types of materials that are contemplated by the contractor during the proposal and contract negotiation phase could be provided for in a contract that would use a City-owned site.

Further, the service agreement between the City and the contractor would control how and when any expanded business activity on the MRF site that the contractor may want to implement on the site. Examples are storage of waste collection trucks, trucks used for other types of businesses, or a truck maintenance garage. The City may or may not want to allow a contractor to have other business functionality on a City-owned site. Thus, it would be advantageous for the private contractor to implement the MRF on a site that it controls.

When the service contract expires, the City would not have any financial or contractual obligation to the private contractor. If MRF services under a new contract to replace the expired contract were to be with a different contractor, the City would have no responsibility to the contractor no longer being used. The contractor would be responsible for obtaining business for the MRF, or else convert or remove the facility with no involvement with the City.

#### **4. Transfer Materials to Existing Phoenix Area MRF for Processing and Marketing**

In this alternative, the City would deliver materials to a transfer station located in the City. Loads of recyclable materials would be tipped on the floor of this facility and then reloaded onto open-top, walking floor semi-trailers. These trailers would be transported to the Phoenix area, where their loads would be tipped on the floor of a MRF. The MRF would process material delivered and market it, in the same manner for a MRF located in Tucson.

To implement this alternative, the City would have three options:

1. Add the alternative to the performance based RFP issued in alternative 3.
2. Issue a standalone performance based RFP for alternative 4.
3. The City could implement recycling transfer functionality and issue an RFP for remote processing.

It is important to note that a transfer station does not exist in Tucson, thus one would have to be constructed. Acquisition of a site and construction of a transfer station would be the responsibility of the contractor for the first two options.

During MRF visits described in Section III, one privately owned and operated MRF in the Phoenix area (Hudson Baylor Corporation) was identified that could successfully process the single stream quantities of materials that the City collects. The contractor expressed interest and indicated they would incur the capital and operations cost of a transfer station, including lease or purchase cost of a site. An estimated cost to construct and operate a privately-owned transportation system needed to deliver recyclable materials to the Phoenix area is presented in Table IV-1. The total estimated cost of \$37 per ton (2008 dollars) would be a cost added to pricing at a MRF located in the Phoenix area. The economics of a MRF located in the Phoenix area would be expected to have economics similar to a MRF located in Tucson, perhaps more attractive, if significantly larger in size, than a similar one in Tucson.

Projected economics of a transfer and transportation system to serve Tucson includes the transfer trailers returning from the Phoenix area empty, thus, the transportation costs are for a round trip of 220 miles. Quantities projected in 2011, the projected first year of operation of a system described in this alternative, would average 185 tons per day, requiring more than eight truckloads, based on 22 tons per load. The facility would require five walking floor trailers that would be dedicated to transporting recyclable materials for daily deliveries, including making two round trip loads each day, for a total of eight to ten loads per day. Six to seven tractor-trailer rigs would be needed to account for spare capacity for maintenance and repair. Because of the need to use walking floor trailers with special construction for self-unloading materials loaded loose into the top of the trailer, it is not anticipated that the system could contract with one or more common carrier trucking companies.

**Table IV-1 – Transfer Station Economics**

**Transfer Haul - Tucson to Phoenix**

**Estimate of First Year Quantities**

Base Year	2008
First Year of Operation	2011
Growth of Recyclable Quantities, percent per year	1.5
Growth of Recyclable Quantities to 2011	1.046
<b>Base Year Quantities</b>	<b>46,100</b>
<b>First Year of Operation Quantities</b>	<b>48,206</b>



**Transfer Station**

**I. Capital Cost**

<b>Land<sup>1</sup></b>	2 acres	\$ 200,000	\$ 400,000
Years To amortize			20
Financing Cost			8%
Total Annual Cost, Land			\$40,741
Total Annual Cost, Land, \$ per square foot			\$ 0.47

**Facility and Equipment**

Total Estimated Cost <sup>2</sup>		\$ 3,000,000
Years to amortize		10
Financing Cost		8%
Total Annual Cost		\$447,088
Annual Capital Cost Per Ton Transferred		\$ 10.12
Annual Operations and Maintenance Cost <sup>2</sup>	\$ 300,000	\$ 6.22
<b>Total Cost, Transfer Facility, Per Ton</b>		<b>\$ 16.34</b>

**Transfer Haul, Per Truck**

Capital Amortization <sup>3</sup>			\$19,207	
Labor, straight time <sup>4</sup>	\$ 20.00	per hr	2080 hr/yr	\$41,600
Overtime	\$ 30.00	per hr	520 hr/yr	\$15,600
Fuel <sup>5</sup>	\$ 4.04	per gallon	5 mpg	\$92,435
Tires <sup>6</sup>	\$ 0.09	per mile		\$10,296
Insurance <sup>7</sup>				\$10,000
Maintenance and Repair				\$12,000
Administration, Other				\$12,000
Subtotal				\$213,138
Contingency			10%	\$21,314
<b>TOTAL</b>				<b>\$234,452</b>
Transportation cost per mile				\$2.05
Transportation cost per trip <sup>8</sup>				\$450.87
<b>Transportation cost per ton<sup>9</sup></b>				<b>20.49</b>

**Total Cost Per Ton, Transfer and Transportation, 2008 dollars \$36.84**

**Notes To Table IV-1.**

1. Source: <http://showcase.costar.com>. September 21, 2008.  
 Palo Verde and I-10, 3.9 ac. Listed for \$838,768.  
 Medina and Country Club Road, 4.87 ac. Listed for \$695,000.
2. Source: GBB.
3. Capital cost of over the road tractor and 110 cubic yard, top loading, walking floor trailer, seven years amortization of 100 percent debt financing.
 

Capital Cost	\$ 100,000
Years to amortize	7
Annual interest rate.	8%

 Assumes no salvage value at end of seven years of use.
4. Labor cost based on two trips in a ten hour shift. Wages estimated.
5. Source: U.S. Energy Information Administration, Gasoline and Diesel Fuel Update. September 15, 2008 prices.
6. Based on tire replacements at 50,000 miles and \$ 250 per tire
7. Other costs estimated.
8. Mileage cost based on one way trip miles:
 

Miles per round trip	110
Miles per day	220
Trips per day	2
Miles per truck per year, based on 260 operational days/year	114,400
9. Trailer capacity 22 tons using aluminum body trailer.

An advantage of this alternative is that a MRF  could not have to be constructed in Tucson for the duration of the contracted services. A MRF has a significant capital cost associated with it; an estimated cost is presented later in this Section. This capital cost would be reduced to the cost of a transfer facility and the fleet of tractor-trailers described in this Section. This alternative would be attractive if one or more private contractors located in Phoenix have processing capacity for the City of Tucson's materials or the ability to add capacity with little or no capital investment. If that would be the case, the additional capital cost of a transfer station would be partially or possibly completely mitigated by the capital cost avoidance due to existing capacity of the contractor's MRF in Phoenix. Additional capacity could be made available by:

1. Capacity in the existing system due to constructing the MRF with greater capacity than needed for initial volume
2. Ability to run the existing system at greater processing rates (speeding up the process) or by adding operating hours, or a combination of both
3. Ability to modify the existing system to increase capacity at a modest capital investment.

A disadvantage of this alternative is the degradation of material quality due to additional handling. Glass containers are the primary cause of degradation. A portion of glass containers collected break with each handling. Some glass containers break in the collection truck and another portion breaks when the loads are tipped at the MRF, piled and pushed into the in-feed conveyors by the wheeled bucket loader. Additional handling with a transfer station would cause more breakage. Broken glass pieces are difficult to remove from paper and plastic where a minor portion of the shards become imbedded in the soft material. This small amount of additional glass contamination in paper would not make

paper fail quality standards, but this factor should be considered when marketing fiber in a reduced demand market.

In Table IV-2, the range of costs for a privately located MRF owner-operator in either the Tucson or Phoenix area are summarized, based on the information provided here. The fees paid/received are more likely to be less if the MRF is located in Tucson, assuming services from WMRA or others in Tucson would respond with similar fee structures and revenue sharing proposals. Allowing for MRFs in Phoenix to respond to a future private MRF services request can be expected to cost more given the additional cost for transferring the recyclable material to Phoenix, notwithstanding the savings in transporting product to markets.

**Table IV-2 - Summary of Estimated Service Fees from Private MRFs in Tucson and Phoenix (2008\$)**

<b>MRF Location</b>	<b>Cost to Transfer to Phoenix (\$ per ton)</b>	<b>Net Revenue Received (Paid) at MRF (\$ per ton)</b>
Tucson	N/A	(\$8.35) to \$32.55 <sup>1</sup>
Phoenix	(\$36.84) <sup>2</sup>	(\$45.19) to (\$4.29) <sup>1</sup>

Notes:

1. Source: Table III-1.
2. Source: Table IV-1.

This alternative would be feasible for the City's system.

### 5. Summary of Public-Private Partnerships and Risks/Rewards

As can be seen in the procurements methods described in this Section, the various roles and responsibilities are assigned to different members in a public-private partnership. In addition, the risks associated with the facility are distributed differently in each alternative. For example, under the A&E alternative, the risk that the facility will work as desired is shared between the A&E firm and the jurisdiction. In the case of the turnkey and full-service methods, the contractor bears the risk that the facility will work when completed. Also, under the full-service method, the contractor accepts the operational risk associated with the facility on a day-to-day basis.

In the solid waste industry, as in other industries, individuals and companies accept risk when they believe that there is an adequate reward. When the reward is too low, the individual or company will go out of business. In other words, the jurisdiction would have to pay its private partner to take any risk involved in a service or facility. Therefore, the City will need to evaluate each potential public-private partnership to determine which risks and rewards it wants to accept and which it believes are best assigned to the private partner.

The City would benefit by fully documenting these risks and rewards, as well as other responsibilities, as private contractors are able to offer their most competitive prices when the risks that contractors are asked to accept are clearly identified and assigned.

Although benefits are available to the City for each of the alternatives presented in this Section, the combination of two factors is significant reason to use the full-service procurement method, independent of whether the City or the contractor provides the site:

- In 1992, when another company built the current processing system operated by WMRA, large-scale, programmatic recycling programs were still within first generation technology. In 1992, the industry was immature and growing with just a small handful of large-scale MRFs in operation in the United States. Since that time, significant advances have been made in collection and processing technologies. Although the pace of advancements has slowed in years approaching 2008, additional changes in processing technology are expected to occur in the next several years, creating the most significant business risk for MRF operators. Private industry is better prepared to react to technology advances, especially among contractors that have more than one MRF, having the ability to spread the cost of keeping up with technology among their multiple facilities.

That is not to say that local governments would not be capable of operating a MRF and advancing its capability in time. The model of a local government entering the business of operating a MRF for the first time does not suggest it infeasible but, rather, a fair comparison would be to a private company without MRF operations experience entering the business. Without significant synergy from other business activities, such as commercial recycling or material handling/manufacturing experience, significant learning curve activities would be incurred. The common outcome of incurring such steep learning curve activities translates into incurring costs over and above that expected from organizations that have appropriate experience.

- Marketing processed materials to mills, historically termed the “scrap” industry, has features similar to other industries. Buyers must rely on suppliers to meet specifications so that problems are not caused in the mills. Also, secondary commodities buyers rely on suppliers for a steady supply of known quantities. Suppliers with large quantities, high quality, and greater resources to revise destinations of shipment, to store quantities on site until markets are ready for deliveries, and timely deliveries generally command premium price. For an organization to enter this phase of the industry with quantities from one facility will, like the technology issue, pose certain challenges. The City would need to have one full-time professional staff member dedicated to material marketing to deal with the various issues of selling materials, without fail, on a daily basis, so that stored product does not exceed facility storage.

A summary of risk assignments is presented in Table IV-3.

**Table IV-3 - Risk Assignment under Alternative Procurement Approaches**

Alternative	Risk Assumed By			
	I – City Owned and Operated/ City Site	II – Contractor Owned and Operated/ City Site	III Contractor Owned and Operated/ Private Site	IV Transfer Haul Material to Phoenix Area
<b>Capital Cost Risks</b>				
Builder	Contractor	Contractor	Contractor	Contractor (T.S. Station)
Operator	City	Contractor	Contractor	Contractor
Site Owner (or Lessee)	City	City	Contractor	Contractor
<b>Risk Element</b>				
Capital costs overruns	City	Contractor	Contractor	Contractor
Additional capital investment to achieve required operating performance	City	Contractor	Contractor	Contractor
Additional facility requirements due to new state or federal legislation	City	Contractor	Contractor	Contractor
Delays in project completion which lead to delays in revenue flow and adverse effect of inflation	City	Contractor	Contractor	Contractor
<b>Operation and Maintenance Costs Risks</b>				
Facility technical failure	City	Contractor	Contractor	Contractor
Excessive facility downtime	City	Owner <sup>+</sup>	Contractor	Contractor
Underestimation of facility O&M requirements (labor, materials, etc.)	City	Owner <sup>+</sup>	Contractor	Contractor
Insufficient solid waste stream	City	City	City	City
Significant changes in the solid waste composition	City	Contractor	Contractor	Contractor
Changes in state and federal legislation which affect facility operations	City	City/ Contractor	City/ Contractor	City/Contractor
Inadequate facility management	City	Contractor	Contractor	Contractor
Underestimation of residue disposal costs	City	Contractor	Contractor	Contractor
<b>Recovered Product Income Risks</b>				
Overestimation of process recovery efficiency	City	Contractor	Contractor	Contractor
Significant change in solid waste composition	City	Contractor	Contractor	Contractor
Overestimation of solid waste quantities	City	City	City	City
Significant adverse changes in market financial condition or local commitment	City	Contractor	Contractor	Contractor
Downward fluctuation in the price of products	City	City/ Contractor	City/ Contractor	City/Contractor
Inability to meet product market specifications	City	Contractor	Contractor	Contractor

## **B. Siting Needs**

The first issue that must be addressed when siting a MRF is zoning. In Tucson, industrial zones I-1 and I-2 allow MRFs. Other zoning districts would have to be eliminated from consideration. A MRF is an industrial facility, similar to other manufacturing facilities that generate noise and have truck traffic. At least five acres would be desired. A significant number of tracts of land within the City have the I-1 and I-2 zoning classification, according to the zoning map published by the City Planning Department.

One reason for a larger site size is to allow truck queuing. It is desirable to queue completely on the MRF site and not on public streets. This should be one objective of a new MRF. Another reason is to have adequate space for storing baled materials, especially in the case for a City-owned and –operated MRF. Ideally, all storage of recovered products would be in the facility. However, the climate in Tucson is conducive to outdoor storage of baled materials and crushed glass. Some litter occurs from this approach. It may be more desirable to limit product storage to trailers, avoiding outdoor storage of bales. MRF operations benefit from having two scales, one for inbound vehicles and one for outbound vehicles. Route collection trucks will have their empty “tare” weights recorded in the scale system records, allowing daily deliveries to require only inbound, loaded weighings. However, if tractor trailer rigs carrying baled product from the MRF are utilized on a regular basis and have tare weights recorded, they will need to be weighed empty on arrival and then again when loaded on exit. To avoid the need for a scale house and full-time staffing, closed circuit television cameras and electronic and pneumatic paper documentation delivery systems can be used. Video monitoring can include identifying the tag numbers on the tractors and trailers, documenting the weighing and positive driver identification. If needed, segmented scales can identify axle weights to assist truck rigs to stay within legal axle limits and overall load limits (80,000 lb).

The MRF will need 480-volt, three-phase power to accommodate the large horsepower electric motors in conveying and baling equipment. This is standard in industrial parks serving true heavy industry. MRFs must be swept, not washed, clean on a daily basis, and there is no need for a process water system. The facility must have an ample water supply for fire protection systems, including a full-scale sprinkler system. The large quantities of paper present in a MRF could cause a large fire, and a fire pump and a fully sprinklered building will likely be required by the City or County.

As mentioned, route collection trucks and 18-wheel tractor trailer rigs must have adequate ingress and egress. Tractor trailer rigs with 53-foot-long trailers are nearly 70 feet in overall length; they require substantial turning radius for entering and leaving the public roadways. The roadway system connecting the MRF to major highways, such as Interstate Highway 10, should be reviewed for their adequacy to handle 80,000 lb rigs and for turning radii at corners such that the rigs do not jump the corner when turning.

A MRF should have a high screened fence at its perimeter, although with adequate buffer other types of screening that are aesthetic, such as a combination of a berm and plantings, could possibly be considered on the road frontage. The perimeter fencing should be a minimum of 10 feet high. The fence, along with the recommended approach of all indoor tipping areas and no outdoor storage of bales, would mitigate blowing litter to a large degree. Buffer to similar heavy industry businesses could be minimal because they are similar land uses. ES should undertake a review of the adequacy of roads and the impact on the community if this site is to be advanced for a new City-developed MRF.

### C. Potential Expansion of Recyclable Materials

Increasing the number of materials and/or increasing the quantity of a material in any recycling program is uncertain until all elements can be clearly identified. In addition to the goal of increased recycling three primary factors cause materials to be considered for future inclusion. First, the materials are known to be present in the waste stream in steady quantities. A material does not need to be present in large quantities. However as a minimum, reliance on the material quantity to be included in route collection loads on a regular basis is required to justify processing equipment at the MRF.

Second, economic markets must be identified to justify collecting the material in the recycling system and processing it. Processing costs at the MRF, presented in this Section, are higher than the City landfill disposal. This gives rise to the need to have a market that provides a positive revenue, net of transportation, of at least \$50 per ton.

Third, the materials are already received at the MRF. In Tucson and in other communities in the U.S. even though those materials are not on the list of accepted material many people put them in collection. The MRF acquires experience in handling them, removing them in the pre-sort area if they would cause problems to the downstream process system, or removing them via manual or automated equipment in the process system. Some MRFs have the ability to add one or two materials to its existing array of materials sorted and aggregated in bunkers or large containers. When a market is identified for a material that has been part of the residue, the material can be assigned a sorting station(s) if available, and trial processing and marketing can be conducted. In some cases, such materials prove to be viable for processing and marketing using these methods. In the case of HDPE and PET, the resins are acceptable but the form of the items is not. For example, PET is used for egg cartons, food tubs and drink glasses. Baled with narrow neck PET bottles, there is no technical reason that these items should not be included.

Certain materials meet one or more of these criteria and thus offer potential in the future:

- Film plastic. A significant portion of recycling program participants place paper or containers in plastic bags before placing them in the set-out containers. Thus, large numbers of plastic bags are received at the MRF. Most film plastic, primarily HDPE and including some LDPE, is currently removed in the pre-sort area in most MRFs and placed in the trash bunker or container. Film plastic not removed prior to screening will wrap around shafts of the disc screens, causing a reduction in separation efficiency and frequent maintenance to repair damage caused to the shafts. New MRF designs can include automated methods to open bags and remove film plastic.

Markets for film plastic exist, but as separation systems in MRFs have not historically been used, film plastics are recovered in programs other than curbside programs, such as retail drop-off at grocery or dry cleaning stores. Thus, significant quantities are received at MRFs, but this material has typically become part of the residue. To facilitate sorting for plastic film, bag splitters and a pneumatic conveying system would be installed in the pre-sort line to deal with even greater quantities expected once this material would be named as an acceptable material. A concept for this system includes overhead intake of the bags through a vacuum system. This system can discharge directly into a baler, reducing handling.

- Other metals. This category would include a wide variety of items made of ferrous metals, aluminum, brass, copper, and others. Currently, aluminum and steel food and beverage containers which are relatively small and uniform in shape are processed in MRFs. Larger metal items are accepted in a number of other residential curbside programs. Examples of larger items are bicycles, auto parts, small appliances, lawn furniture, pots and pans, and other similar items. Like film plastic, larger metal items would pose problems to the processing equipment, such as gouging conveyor belts and jamming disc screens. It is preferable to remove these items in the pre-sort system. The resulting mixture of large metal types is an acceptable feed stock for metal scrap processors who have the equipment to process the material further. These processors generally will pay for this mixed scrap metal.
- Number 3 through 7 plastics. Depending on quantity, two or more sorting points on the pre-sort conveyor may be required. Three sorting points would be ideal to enable each sorter at the pre-sort station to pick film plastic and feed it through each pneumatic hood, to pick large rigid 3 through 7 plastics, and also to remove other trash, especially materials that would cause damage to the downstream process system. Smaller plastic items could be allowed past the pre-sort to the process system. An optical sorting system would be desirable to perform automatic removal as opposed to approximately two or more sorters required if these materials were manually separated.

Larger rigid plastics having these number designations include water containers greater than one gallon capacity and other containers up to five gallon buckets. These larger containers have dimensions that are too great to pass through some of the process system elements. As MRFs receive these rigid plastics in quantities, some of them, including the Hudson Baylor MRF in Scottsdale, have found export markets for them.

The list presented above is not intended to be exhaustive of materials that could be added in the future. However, MRF operators that would take an interest in the City's project have some experience with these three types of materials, providing evidence that they may be feasible for the future. Automated technology may require some level of development to be reliable to the degree that other, more mature, elements of systems that would be proposed for services to the City. However, manual sorting included in the concepts described here would serve to ensure success, success defined as sorting to produce marketable materials and avoiding problems with process equipment.

#### **D. Capital and Operations Cost**

An important element of feasibility analysis is to identify expected capital and operations cost. In this subsection, estimated costs are presented for a MRF to be owned and operated by the City that would serve the City for 20 years of operation. The capital costs presented assume the MRF meets at least a LEED Silver design standard.

A MRF to serve the City would be sized to handle quantities expected for each year of the planning period. Based on the City collecting approximately 46,100 tons in FY 2008, this quantity would be expected to grow at 1.5 percent per year, the same as expected population growth. FY 2008 translates into approximately 180 tpd on a five-day week basis. Nearly three years for planning and implementation has been allowed, putting first year of operation at FY2011. Quantities projected for 20 years after startup, or FY 2030,

are approximately 250 tpd. Thus, a design capacity of 25 tons per hour (tph) was chosen, a rating for a single large scale processing system. Above 25 tph, a second process system would be required, requiring a larger building and doubling of the process equipment capital cost.

A 25 tph system would be capable of 175 tons in seven hours of actual processing, well within a single eight-hour shift. With this system, operating hours could be expanded growing to ten hours of actual processing in the distant years as 250 tons per day was attained. These greater hours of operation could be handled with a split shift (a second shift running less than eight hours). For the private operation alternative and likelihood that the operator would bring commercial business into the MRF, daily quantities would be even higher, improving the economics of the second shift of plant operations.

Additional quantities of materials generated by increasing the types of items in the recycling program have not been included. Also, quantities provided by other jurisdictions will not be an integral part of this cost estimate. Quantities currently collected by Pima County in the unincorporated portions of the County amount to less than one percent of quantities collected by the City. Such additional quantities could be easily incorporated into this MRF at the sizing proposed in this study. As additional feed stock is added, the facility could move from eight-hour shifts to ten-hour shifts as required.

Projected capital cost, operations and maintenance costs, revenue estimates, and 20-year life-cycle costs for this conceptual design are presented in Tables IV-4 through IV-7.

As presented in Table IV-4, a facility that can process 250 tons per day would require a 50,000-square-foot building with approximately 6,000 square feet allocated for office space and staff dressing rooms on five acres. Land purchase price and other acquisition costs, and demolition costs, if needed, are not included. It is assumed that the vacant land will be provided and if a siting study is needed, it will be paid by another source. It is assumed that construction site work will include the need for all new utilities. Costs for power feed lines and transformers are not included. Water, sewer and sanitary lines are assumed to terminate at the building thus costs for main water, sewer and sanitary lines are not included. Cost of the processing equipment does not include a glass beneficiation system.

Cost factors are based on RRT's historical costs on comparable past projects constructed in the past two years that have been adjusted to 2008 pricing. Applicable sales tax is not included. The total capital cost is then assumed to be paid through City-issued certificates of participation over a 20-year period at a 5.5% interest rate. This results in an annual capital cost \$2.3 million.

In 2008, significant increases in prices for process systems have been experienced. This is due to a large degree to price increases for raw materials, especially steel. Steel prices, in particular, reached levels more than 40 percent higher in 2008 than prior to the increase in 2007. Another factor is the lower U.S. dollar purchasing power when purchasing system components from manufacturers located in European countries. Another factor is the higher costs associated with designing a system that has provisions for adding materials to the recycling program, usually resulting in longer sorting conveyors or similar effects.

Replacement funds for both fixed and mobile equipment are also calculated. Because mobile equipment is expected to have a life cycle of 10 years, it is assumed money will need to be set aside annually so that at the end of 10 years funds will be available to purchase

replacement equipment. The same is assumed for the fixed equipment but with a life cycle of 20 years. Building replacement costs are not included. Both replacement funds account for inflation in equipment prices. It is recommended to set aside nearly \$130,000 each year for the first 10 years and over \$180,000 each year for the second 10 years for the mobile equipment replacement fund. \$1.2 million each year for 20 years is needed for the fixed equipment replacement fund.

Operations and maintenance costs are estimated for a 250-tons-per-day facility operating five days per week and are shown in Table IV-5. Salaries for FY 2008 are estimated for the Tucson region, and a fringe benefit factor of 40% is assumed. Labor costs for a scale operator are not included because it is assumed the scale duties will be relegated to administration personnel. While the current estimate of residual waste for disposal based on results from June and December 2006 is 17.2%, it is assumed through actions by generators and by processing, the residue rate will improve to 10%. An operations and maintenance cost per ton for processing 250 tons per day is estimated at \$44 per ton in FY 2008. For FY 2011, the operations and maintenance cost per ton is \$49 per ton.

The net cost of receiving MRF services are driven by a number of factors, such as:

- Size and design of the facility;
- Location of the facility;
- Ownership of the facility;
- Length of contractual arrangement;
- Allocation of risks, as described in Subsection A, priced by the service provider;
- Value of recyclables;
- Amount and cost of residue disposal; and
- Direct or implicit sharing of product revenues, net of transportation costs to get to purchaser, with the customer.

Recyclable products are commodities whose value rises and falls with demand, both domestic and worldwide. For Tucson, Table IV-6 provides a range of commodity values that have been experienced over the last five years. This review shows that the weighted average falls between weighted averages of \$60 and \$160 per ton with the current price being about \$122 per ton. These prices are f.o.b. Tucson or f.o.b. domestic mill. It should also be recognized, that as this report is authored, there has been significant downward flux in the market demand and pricing for recyclable materials. It will be important to track the marketplace as decisions about future MRFs are made.

Table IV-7 shows a summary of the costs and revenues over a 20-year period using the calculated capital and operations and maintenance costs in Tables IV-4 and IV-5, respectively. As noted earlier, it is assumed first year of operation is FY 2011, and quantities projected for 20 years after startup, or FY 2030, are approximately 250 tons per day. Tonnage and costs data from FY 2008 are used and escalated by a growth rate of 1.5% and an inflation rate of 3.5% each year, respectively. An assumed \$30 per ton tipping fee is used to calculate disposal costs for the first year, and the tip fee increases by inflation each year. The tip fee is used to contribute towards a closure fund for the landfill.

For projection purposes, the life-cycle model has been run at the low (worst) case of \$60 per ton net revenue, at projected high revenue, and at average revenue levels of \$108 per ton net (Table IV-7).

Revenues in Table IV-7 include interest from the replacement fund for both fixed and mobile equipment with a fund interest rate of 3.5% and revenue from the sale of recyclable materials. Revenue from the sale of recyclable materials is calculated by applying the proportion of total quantities to the applicable unit price.

Material proportions are based on average levels over FY 2008 data, adjusted to reflect an improved residual waste level of ten percent of total quantities. Material revenue is based on five-year low, five-year high, and five-year average prices obtained via *Waste News'* published historical data. It is assumed that the City will receive 80 percent of the revenue from the sale of recyclable materials, and in addition to the City paying the MRF operator fee, the MRF operator will receive 20 percent of the revenue from the sale or recyclable materials and the interest from the replacement funds. Sharing revenue in a publicly owned/controlled MRF is common service pricing contracting practice, and with more than the majority of the revenue accruing to the public sector. Having some portion credited to the operator creates an incentive to meet or exceed market specifications and help assure ongoing efficient MRF operations and marketing.

With regard to recyclable materials, prices for recyclable materials have fallen since peaking in July 2008. As the economy improves, the price of virgin materials will follow, increasing the value of recyclable materials.

**Table IV-4 - Estimated MRF Capital Costs**

	<u>Size or Number</u>	<u>Cost Factor (2)</u>	<u>Units</u>	<u>Element Cost</u>
<b>Building Size (sq. ft.)</b>	50,000			
<b>Site Size (Acres)</b>	5			
Capacity - TPD, average, 5 days/week (3)				250
Land (4)		\$0	per Acre	\$0
Demolition		\$0	per sq. ft..	\$0
Clearing & Rough Grading		\$9,000	per Acre	\$45,000
Site Work, incl. utilities (5)		\$90,000	per Acre	\$450,000
Building & Foundations		\$150	per sq. ft..	\$7,500,000
Mechanical & Electrical		\$25	per sq. ft..	\$1,250,000
Office Building	6,000	\$150	per sq. ft..	\$900,000
Scale House	150	\$200	per sq. ft..	\$30,000
Rail Line		\$0	per foot	\$0
A&E Design Engineering & Constr. Mgt		7%	percent	\$712,250
Procurement & Construction Monitoring		5%	percent	\$508,750
Contingency @ 15%		15%	percent	<u>\$1,526,250</u>
Subtotal (6)				\$12,922,250
<b>Equipment Requirements</b>				
Scale(s), incl. Data Management	2	\$125,000	each	\$250,000
Processing Equipment (7)	1	\$9,000,000	each	\$9,000,000
Front-End Loader(s)	2	\$300,000	each	\$600,000
Grapple(s)	0	\$125,000	each	\$0
Sweeper	1	\$50,000	each	\$50,000
Fork Lift	2	\$30,000	each	\$60,000
Shipping & Misc. Allowance @ 20%		20%	percent	<u>\$1,992,000</u>
Subtotal (6)				\$11,952,000
<b>Other Capital Costs</b>				
Performance Bond @ 1.5%		1.5%	percent	\$373,114
City Project Management and Oversight @ 3%		3%	percent	\$746,228
<b>Total Capital Cost (2008\$)</b>				<b>\$25,993,591</b>
<b>Total Capital Cost (2010\$)</b>				<b>\$27,844,985</b>
<b>Annualized Capital Cost, Certificates of Participation</b>		116500 per \$ million		\$3,243,941

		TPD
Days of operation per year	260	
TOTAL Tonnage Yr 1	46,100	177
TOTAL Tonnage Yr 20	63,967	246

**Replacement Fund**

Year	Mobile Equipment (8)	Fixed Equipment (9)
	\$944,628	\$12,306,768
10	\$1,287,430	
annual	\$128,743	
20	\$1,816,048	\$23,659,778
annual	\$181,605	\$1,182,989

Notes to Table IV-4:

- (1) Costs of siting study are not included
- (2) Capital cost estimates are based on RRT's historical costs on comparable past projects constructed in the past two years that have been adjusted to 2008 pricing.
- (3) MRF is sized for year 2030 tonnage
- (4) MRF land and demolition cost not included.
- (5) Power feed line/s and transformer not included. Water, sewer and sanitary lines terminated at building. Main water, sewer and sanitary lines not included.
- (6) Any applicable sales taxes not included.
- (7) Glass beneficiation system not included.
- (8) Mobile equipment is annualized over 10 years - lifetime for mobile equipment
- (9) Fixed equipment is annualized over 20 years - lifetime for mobile equipment

**Table IV-5 - Estimated MRF  
 Operations and Maintenance Costs**

<b>Labor Category</b>	<b>Salary (1)</b>	<b>Labor No.</b>	<b>Labor Cost</b>
Plant Manager	\$80,000	1	\$80,000
Operations Foreman	\$55,000	2	\$110,000
Marketing Manager	\$50,000	1	\$50,000
Scale Operator (2)	\$30,000	0	\$0
Equipment Operators	\$35,000	3	\$105,000
Grapple Operators	\$35,000	1	\$35,000
Spotters on Tip Floor	\$31,000	1	\$31,000
Sorters	\$22,000	20	\$440,000
Laborers	\$22,000	2	\$44,000
Subtotal		31	\$895,000
Fringe Benefits	40%		\$358,000
Overtime Multiplier	10%		\$89,500
Subtotal Labor			\$1,342,500
Fuel (On-site only) @ X gph/Unit	6	\$4.00	\$0
Equipment Maintenance	2%		\$239,040
Site/Building Maintenance (% of Capital)	1%		\$129,223
Utilities (electric, water, sewage)	\$120,000		\$120,000
Insurance	1%		\$259,936
Miscellaneous Supplies/Services (Allowance)			\$75,000
Residue Disposal	10%	\$33	\$160,341
Security	\$20,000		\$20,000
Subtotal Other			\$1,003,539
Profit, Overhead, and Contingency, all costs (25%)		25%	\$586,510
Total Annual Operating Costs			\$2,932,549
Total Tons per Day Handled/Transferred			185.4
Total Tons Per Year Handled/Transferred			48,206
Operating Days per Year	260		
Operating/Maintenance Cost, \$ per ton (2008\$)			\$60.83
Annualized Capital Cost, \$ per ton			\$67.29
Total Cost, \$ per ton			\$128.13
Operating/Maintenance Cost, \$ per ton (2011\$)			\$67.45

Notes:

- (1) Salaries based on U.S. Mainland estimate, 2008
- (2) Scale duties shall be relegated to admin. personnel

**Table IV-6 - Estimated Revenues for Single-stream MRF**

<b>Recyclable Materials and Residue Tucson, Arizona</b>	<b>Actual Percent</b>	<b>Projected Percent</b>	<b>2008 Prices/Ton (3)</b>	<b>2011 Prices/Ton</b>	<b>5 Year Low Prices/Ton (4)</b>	<b>5 Year High Prices/Ton (4)</b>	<b>5 Year Average Prices/Ton</b>
	<b>of Total (1)</b>	<b>of Total (2)</b>					
Mixed Glass, 3 colors	12.9%	14.2%	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Aluminum Cans	0.9%	1.0%	\$2,200.00	\$2,439.18	\$1,160.00	\$1,800.00	\$1,480.00
Tin Cans	2.2%	2.4%	\$317.00	\$351.46	\$142.00	\$230.00	\$186.00
HDPE, Color	1.4%	1.5%	\$373.00	\$413.55	\$200.00	\$760.00	\$480.00
HDPE, Natural	0.9%	1.0%	\$640.00	\$709.58	\$440.00	\$820.00	\$630.00
PET	3.0%	3.3%	\$430.00	\$476.75	\$240.00	\$72.00	\$156.00
OCC	12.8%	14.0%	\$140.00	\$155.22	\$50.00	\$160.00	\$105.00
ONP PS7	38.1%	41.9%	\$185.00	\$205.11	\$60.00	\$160.00	\$110.00
Mixed Paper	9.1%	10.0%	\$107.00	\$118.63	\$35.00	\$135.00	\$85.00
Residue	18.0%	10.0%	\$27.06	\$30.00	\$30.00	\$30.00	\$30.00
<b>Total</b>	<b>99.3%</b>	<b>99.3%</b>					

Table IV-7 - Estimated MRF Life-cycle Costs - Base Case

Summary

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
<b>Expenses</b>																			
Tonnage (1)	48,206	48,929	49,663	50,408	51,164	51,931	52,710	53,501	54,303	55,118	55,945	56,784	57,636	58,500	59,378	60,268	61,172	62,090	63,021
Tonnage per Day (Operate 5 days/week)	185	188	191	194	197	200	203	206	209	212	215	218	222	225	228	232	235	239	242
Annualized Capital Costs (2)	\$3,243,941	\$3,243,941	\$3,243,941	\$3,243,941	\$3,243,941	\$3,243,941	\$3,243,941	\$3,243,941	\$3,243,941	\$3,243,941	\$3,243,941	\$3,243,941	\$3,243,941	\$3,243,941	\$3,243,941	\$3,243,941	\$3,243,941	\$3,243,941	\$3,243,941
O&M Costs (3)	\$3,251,354	\$3,415,629	\$3,588,203	\$3,769,497	\$3,959,951	\$4,160,027	\$4,370,213	\$4,591,018	\$4,822,979	\$5,066,660	\$5,322,653	\$5,591,580	\$5,874,095	\$6,170,883	\$6,482,667	\$6,810,204	\$7,154,290	\$7,515,760	\$7,895,494
Replacement Fund - Mobile Equipment (4)	\$128,743	\$128,743	\$128,743	\$128,743	\$128,743	\$128,743	\$128,743	\$128,743	\$128,743	\$128,743	\$181,605	\$181,605	\$181,605	\$181,605	\$181,605	\$181,605	\$181,605	\$181,605	\$181,605
Replacement Fund - Fixed Equipment (4)	\$1,182,989	\$1,182,989	\$1,182,989	\$1,182,989	\$1,182,989	\$1,182,989	\$1,182,989	\$1,182,989	\$1,182,989	\$1,182,989	\$1,182,989	\$1,182,989	\$1,182,989	\$1,182,989	\$1,182,989	\$1,182,989	\$1,182,989	\$1,182,989	\$1,182,989
<b>Total Expenses</b>	<b>\$7,807,027</b>	<b>\$7,971,301</b>	<b>\$8,143,876</b>	<b>\$8,325,170</b>	<b>\$8,515,624</b>	<b>\$8,715,700</b>	<b>\$8,925,886</b>	<b>\$9,146,691</b>	<b>\$9,378,652</b>	<b>\$9,622,333</b>	<b>\$9,931,188</b>	<b>\$10,200,115</b>	<b>\$10,482,629</b>	<b>\$10,779,418</b>	<b>\$11,091,202</b>	<b>\$11,418,738</b>	<b>\$11,762,824</b>	<b>\$12,124,294</b>	<b>\$12,504,028</b>
<b>Revenues</b>																			
Interest from Mobile Equipment Replacement Fund (5)	\$4,506	\$9,170	\$13,997	\$18,993	\$24,163	\$29,515	\$35,054	\$40,787	\$46,721	\$52,862	\$6,356	\$12,935	\$19,744	\$26,791	\$34,085	\$41,634	\$49,447	\$57,534	\$65,904
Interest from Fixed Equipment Replacement Fund (5)	\$41,405	\$84,258	\$128,612	\$174,518	\$222,031	\$271,207	\$322,103	\$374,782	\$429,304	\$485,734	\$544,139	\$604,589	\$667,154	\$731,909	\$798,930	\$868,297	\$940,092	\$1,014,400	\$1,091,309
Recyclables (6)																			
Recyclables Subtotal (Low)	\$3,181,402	\$3,342,142	\$3,511,004	\$3,688,397	\$3,874,754	\$4,070,526	\$4,276,189	\$4,492,243	\$4,719,214	\$4,957,652	\$5,208,138	\$5,471,279	\$5,747,715	\$6,038,118	\$6,343,194	\$6,663,684	\$7,000,367	\$7,354,060	\$7,725,624
Recyclables Subtotal (High)	\$7,170,824	\$7,533,130	\$7,913,741	\$8,313,583	\$8,733,627	\$9,174,893	\$9,638,454	\$10,125,437	\$10,637,025	\$11,174,461	\$11,739,050	\$12,332,166	\$12,955,249	\$13,609,813	\$14,297,448	\$15,019,827	\$15,778,704	\$16,575,923	\$17,413,421
Recyclables Subtotal (Average)	\$5,176,113	\$5,437,636	\$5,712,372	\$6,000,990	\$6,304,190	\$6,622,709	\$6,957,322	\$7,308,840	\$7,678,120	\$8,066,057	\$8,473,594	\$8,901,722	\$9,351,482	\$9,823,965	\$10,320,321	\$10,841,756	\$11,389,535	\$11,964,992	\$12,569,523
<b>Total Revenues (Low)</b>	<b>\$3,227,312</b>	<b>\$3,435,570</b>	<b>\$3,653,613</b>	<b>\$3,881,908</b>	<b>\$4,120,948</b>	<b>\$4,371,247</b>	<b>\$4,633,346</b>	<b>\$4,907,812</b>	<b>\$5,195,238</b>	<b>\$5,496,248</b>	<b>\$5,758,633</b>	<b>\$6,088,802</b>	<b>\$6,434,613</b>	<b>\$6,796,818</b>	<b>\$7,176,209</b>	<b>\$7,573,615</b>	<b>\$7,989,906</b>	<b>\$8,425,995</b>	<b>\$8,882,837</b>
<b>Total Revenues (High)</b>	<b>\$7,216,734</b>	<b>\$7,626,558</b>	<b>\$8,056,350</b>	<b>\$8,507,093</b>	<b>\$8,979,821</b>	<b>\$9,475,615</b>	<b>\$9,995,612</b>	<b>\$10,541,006</b>	<b>\$11,113,049</b>	<b>\$11,713,056</b>	<b>\$12,289,546</b>	<b>\$12,949,689</b>	<b>\$13,642,146</b>	<b>\$14,368,512</b>	<b>\$15,130,463</b>	<b>\$15,929,758</b>	<b>\$16,768,243</b>	<b>\$17,647,857</b>	<b>\$18,570,634</b>
<b>Total Revenues (Average)</b>	<b>\$5,222,023</b>	<b>\$5,531,064</b>	<b>\$5,854,981</b>	<b>\$6,194,501</b>	<b>\$6,550,384</b>	<b>\$6,923,431</b>	<b>\$7,314,479</b>	<b>\$7,724,409</b>	<b>\$8,154,144</b>	<b>\$8,604,652</b>	<b>\$9,024,089</b>	<b>\$9,519,246</b>	<b>\$10,038,379</b>	<b>\$10,582,665</b>	<b>\$11,153,336</b>	<b>\$11,751,687</b>	<b>\$12,379,075</b>	<b>\$13,036,926</b>	<b>\$13,726,735</b>
Revenue Share to City (Low) (7)	\$2,545,121	\$2,673,714	\$2,808,803	\$2,950,718	\$3,099,803	\$3,256,420	\$3,420,951	\$3,593,795	\$3,775,371	\$3,966,122	\$4,166,510	\$4,377,023	\$4,598,172	\$4,830,495	\$5,074,555	\$5,330,947	\$5,600,294	\$5,883,248	\$6,180,499
Revenue Share to City (High) (7)	\$5,736,659	\$6,026,504	\$6,330,993	\$6,650,866	\$6,986,901	\$7,339,914	\$7,710,764	\$8,100,350	\$8,509,620	\$8,939,569	\$9,391,240	\$9,865,733	\$10,364,199	\$10,887,850	\$11,437,959	\$12,015,862	\$12,622,963	\$13,260,738	\$13,930,737
Revenue Share to City (Average) (7)	\$4,140,890	\$4,350,109	\$4,569,898	\$4,800,792	\$5,043,352	\$5,298,167	\$5,565,857	\$5,847,072	\$6,142,496	\$6,452,845	\$6,778,875	\$7,121,378	\$7,481,185	\$7,859,172	\$8,256,257	\$8,673,404	\$9,111,628	\$9,571,993	\$10,055,618
MRF Operator's Revenue (Low)	\$682,191	\$761,857	\$844,809	\$931,190	\$1,021,145	\$1,114,827	\$1,212,395	\$1,314,017	\$1,419,867	\$1,530,126	\$1,592,123	\$1,711,779	\$1,836,440	\$1,966,323	\$2,101,654	\$2,242,668	\$2,389,613	\$2,542,746	\$2,702,338
MRF Operator's Revenue (High)	\$1,480,075	\$1,600,054	\$1,725,357	\$1,856,227	\$1,992,919	\$2,135,700	\$2,284,848	\$2,440,656	\$2,603,429	\$2,773,488	\$2,898,305	\$3,083,957	\$3,277,947	\$3,480,662	\$3,692,505	\$3,913,897	\$4,145,280	\$4,387,119	\$4,639,897
MRF Operator's Revenue (Average)	\$1,081,133	\$1,180,955	\$1,285,083	\$1,393,709	\$1,507,032	\$1,625,263	\$1,748,622	\$1,877,337	\$2,011,648	\$2,151,807	\$2,245,214	\$2,397,868	\$2,557,194	\$2,723,493	\$2,897,079	\$3,078,282	\$3,267,447	\$3,464,933	\$3,671,117
<b>Net Revenue/(Cost) to City (Low)</b>	<b>(\$5,261,905)</b>	<b>(\$5,297,587)</b>	<b>(\$5,335,073)</b>	<b>(\$5,374,452)</b>	<b>(\$5,415,821)</b>	<b>(\$5,459,280)</b>	<b>(\$5,504,934)</b>	<b>(\$5,552,896)</b>	<b>(\$5,603,281)</b>	<b>(\$5,656,211)</b>	<b>(\$5,764,677)</b>	<b>(\$5,823,092)</b>	<b>(\$5,884,457)</b>	<b>(\$5,948,923)</b>	<b>(\$6,016,646)</b>	<b>(\$6,087,791)</b>	<b>(\$6,162,530)</b>	<b>(\$6,241,046)</b>	<b>(\$6,323,529)</b>
<b>Net Revenue/(Cost) to City (High)</b>	<b>(\$2,070,368)</b>	<b>(\$1,944,798)</b>	<b>(\$1,812,883)</b>	<b>(\$1,674,304)</b>	<b>(\$1,528,722)</b>	<b>(\$1,375,786)</b>	<b>(\$1,215,122)</b>	<b>(\$1,046,341)</b>	<b>(\$869,032)</b>	<b>(\$682,764)</b>	<b>(\$539,947)</b>	<b>(\$334,382)</b>	<b>(\$118,430)</b>	<b>\$108,432</b>	<b>\$346,757</b>	<b>\$597,123</b>	<b>\$860,139</b>	<b>\$1,136,444</b>	<b>\$1,426,709</b>
<b>Net Revenue/(Cost) to City (Average)</b>	<b>(\$3,666,136)</b>	<b>(\$3,621,193)</b>	<b>(\$3,573,978)</b>	<b>(\$3,524,378)</b>	<b>(\$3,472,272)</b>	<b>(\$3,417,533)</b>	<b>(\$3,360,028)</b>	<b>(\$3,299,618)</b>	<b>(\$3,236,156)</b>	<b>(\$3,169,488)</b>	<b>(\$3,152,312)</b>	<b>(\$3,078,737)</b>	<b>(\$3,001,444)</b>	<b>(\$2,920,245)</b>	<b>(\$2,834,945)</b>	<b>(\$2,745,334)</b>	<b>(\$2,651,196)</b>	<b>(\$2,552,301)</b>	<b>(\$2,448,410)</b>
<b>Net Revenue/(Cost) to City Per Ton (Low)</b>	<b>(\$109)</b>	<b>(\$108)</b>	<b>(\$107)</b>	<b>(\$107)</b>	<b>(\$106)</b>	<b>(\$105)</b>	<b>(\$104)</b>	<b>(\$104)</b>	<b>(\$103)</b>	<b>(\$103)</b>	<b>(\$103)</b>	<b>(\$103)</b>	<b>(\$102)</b>	<b>(\$102)</b>	<b>(\$101)</b>	<b>(\$101)</b>	<b>(\$101)</b>	<b>(\$101)</b>	<b>(\$100)</b>
<b>Net Revenue/(Cost) to City Per Ton (High)</b>	<b>(\$43)</b>	<b>(\$40)</b>	<b>(\$37)</b>	<b>(\$33)</b>	<b>(\$30)</b>	<b>(\$26)</b>	<b>(\$23)</b>	<b>(\$20)</b>	<b>(\$16)</b>	<b>(\$12)</b>	<b>(\$10)</b>	<b>(\$6)</b>	<b>(\$2)</b>	<b>\$2</b>	<b>\$6</b>	<b>\$10</b>	<b>\$14</b>	<b>\$18</b>	<b>\$23</b>
<b>Net Revenue/(Cost) to City Per Ton (Average)</b>	<b>(\$76)</b>	<b>(\$74)</b>	<b>(\$72)</b>	<b>(\$70)</b>	<b>(\$68)</b>	<b>(\$66)</b>	<b>(\$64)</b>	<b>(\$62)</b>	<b>(\$60)</b>	<b>(\$58)</b>	<b>(\$56)</b>	<b>(\$54)</b>	<b>(\$52)</b>	<b>(\$50)</b>	<b>(\$48)</b>	<b>(\$46)</b>	<b>(\$43)</b>	<b>(\$41)</b>	<b>(\$39)</b>
Cumulative Replacement Fund - Mobile Equipment	\$133,249	\$271,162	\$413,902	\$561,637	\$714,544	\$872,802	\$1,036,599	\$1,206,129	\$1,381,592	\$1,563,197	\$187,961	\$382,501	\$583,849	\$792,245	\$1,007,934	\$1,231,173	\$1,462,225	\$1,701,364	\$1,948,872
Check										\$1,287,430									
Cumulative Replacement Fund - Fixed Equipment	\$1,224,394	\$2,491,641	\$3,803,242	\$5,160,749	\$6,565,769	\$8,019,964	\$9,525,056	\$11,082,827	\$12,695,119	\$14,363,842	\$16,090,970	\$17,878,547	\$19,728,690	\$21,643,588	\$23,625,507	\$25,676,793	\$27,799,875	\$29,997,264	\$32,271,561
Check																			

Notes:

- (1) Tonnage increases by growth rate (1.5%) with project beginning year 2011
- (2) Capital interest is 5.5%; land will be provided
- (3) MRF is designed to handle year 2030 tonnages thus O&M costs increase by inflation rate (3.5%) only
- (4) Replacement funds account for inflation rate; fixed equipment life is 20 years, mobile equipment life is 10 years, and building replacement is not included
- (5) Replacement Fund Interest rate is 3.5%.
- (6) Recycling revenue increase by growth and inflation rates; Source for range for low, high, and average recycling revenue values: Table IV-5.
- (7) Contract will be 80 percent revenue share to City and 20 percent to Contractor.

## V. CONTRACTUAL TERMS AND CONDITIONS

A contract to provide services for processing and marketing recyclables materials for the City, similar to the City's current contract, should necessarily be a long-term arrangement. The stationary process equipment and mobile equipment needed to operate a MRF are capital intensive and will require several years of potentially profitable operation for a private contractor to justify making that investment. Most or all equipment will be subject to federal income tax regulations that require the owner to depreciate equipment over several years; therefore, most private contractors will require a contract for service with the City for at least ten years as an adequate incentive for the contractor to invest funds to construct a MRF. 15- or 20-year contracts are not unusual in this business.

Because the relationship between the contractor and the City will be close and long, setting up the details of expected actions by the two parties is important. Any action or operational aspect falling short of expectations could become an ongoing issue, in some cases curable by mutual agreement between the contractor and the City. Those actions on which the City is not able to reach agreement with the contractor during the term of the contract can become a source of dissatisfaction. Equally important, the City would have to wait until the contract expires and then revise the requirement to ensure that source of dissatisfaction will be reversed to meet the City's expectation(s).

The preferred approach begins with development of the Request for Proposals for MRF Services (RFP). This will ensure that the City avoids undesirable aspects of MRF services and simultaneously develops a comfort level before entering an agreement that may run ten years or longer. In this section, a summary of important points to include in the RFP to assist in satisfying the City over the contract period is presented. Numerous details would accompany each point in the RFP; however, the details of each requirement are not presented here but would be developed with the RFP. Details of certain items would be common to other MRF procurements in the U.S., while other items would be developed to specifically address the City's situation and needs. This section does not include usual administrative and commercial terms of the City Procurement Department that would be expected with the RFP.

Beyond development of the RFP, other important steps in the selection of a MRF contractor include proposal evaluation, the process of clarification of ambiguous points in each proposal, potential interviews with proposers, contract development, and final negotiations.

Important points to include in the RFP follow:

1. Design and Construction Phase - Clearly specify the parameters upon which contractor proposals will be evaluated. If a scoring or points method is used, provide the details of scoring or points. In response, contractors will more consistently describe those parts of their proposals. A recommended list of parameters includes:
  - a. City objectives, such as diversion rate.
  - b. Proposed site feasibility and proximity to population centroids.
  - c. Experience. Experience in **operations** of single-stream processing and other recyclables processing.

- d. Marketing plan. All materials that generators may put into the collection container should be fully marketed, that is, multiple markets should be proposed if one market will take less than 100 percent of the material.
  - e. Materials markets and net revenue formula to City. Monthly payment by contractor to City.
  - f. Proposal security, performance bond (during operational years of the MRF), payment bond
2. Facility Design and Operations - Requirements in the following discussion could be written into the RFP.

For a new MRF sited at the City-owned Los Reales Landfill or other site - the City would want greater control over the MRF and should specify limitations or ranges on certain parameters, such as:

- a. Conceptual design – such as building size and architectural style
- b. Site plan – to have control over location of trailer storage, limit on storage location of other vehicles, and a prohibition on making the site a waste collection vehicle or waste collection container storage lot. Site plan limitation also would specify limitation on acreage that would be provided.
- c. Hours of operation – to more closely correspond to other facilities at the landfill site
- d. Limit the quantity of processed (baled) material storage on site
- e. Operational approaches to prevent materials from exiting the building and becoming litter
- f. Placement of exterior lights and other security features

For a new MRF sited at a contractor-provided site – Contractors will typically require maintaining control over certain features of the MRF on a site the contractor selects. The contractor may want to store vehicles used by its waste or recycling collection business, as well as collection containers. The contractor also may want to process materials other than those supplied by the City curbside residential recycling program, such as other metals or other industrial materials. For a site provided by City or Contractor - Whether the MRF is sited at the Los Reales Landfill or at a site provided by the contractor, the City could influence building design elements by specifying functionality requirements for education, such as:

- a. Parking for a specified number of visitor vehicles and for one bus
- b. Meeting room for presentations to visitor groups and other educational activities
- c. Observation areas – A mezzanine walkway at the second level will provide safe viewing of several process activities without interfering with process floor operations. This approach has been used in numerous other facilities. An

- additional benefit is that the viewing areas, isolated from process operations, would allow school-age children to view the process.
3. Schedule - A listing of the major milestone dates that the City expects during the selection and contract development stages, construction, and commencement of commercial operations would aid in the contractors' understanding of the timing of the various resources that the contractor must make available to the City to conclude a successful procurement process and then meet construction deadlines. For the alternative that the contractor will provide a site, the City would need to allow an adequate amount of time between RFP issuance and proposal submittal for contractors to conduct the site search activities necessary for their proposal to be responsive to the RFP. Contractors would need time to identify and conclude at least a preliminary level of commitment from the owner – for sale or for lease to the contractor.
  4. City Responsibilities - This section should spell out the City's responsibilities during the construction of a new facility and during the term of MRF services provided by the contractor. The primary reason for this section is to let the contractor understand all of the items that the City will provide.
  5. Acceptance Test - Whether the City or the contractor provides the site, the City should expect the contractor to prove process performance.
    - a. Quantities - The RFP should specify performance that matches the greatest quantity expected over the life of the contract. Annual quantities will be greatest during the last year of the contract, as quantities are expected to grow with population. The City could require the contractor to accumulate a portion of one day's receipts for a following day test, to ensure that the greater future daily quantity would be tested. Similar to the capacity provided in the conceptual design in a prior section of this report, the MRF should be required to receive and process the tested amount over a time period proposed by the Contractor. This requirement will help ensure that the contractor does not undersize the facility as a means to reduce the initial capital cost.
    - b. Process Efficiency - Two aspects of process efficiency should be tested. The first aspect is separation to achieve the grade requirements or specifications for each material in its ready-to-ship condition. Material grade requirements will be included in the Marketing Plan submitted by the contractor with the proposal. These requirements usually specify allowable quantities, as a percent of the total, of other materials, such as other grades of paper, and of contaminants, materials that cannot be processed by the mill receiving processed recyclables.

Another aspect is residue quantity and quality. Recycling program participants always place some small amount of non-recyclable materials into the collection system. The MRF process removes these materials and they form the process residue from daily operations. Also, some quantities of recyclable materials fail to be separated during the process, adding to residue quantities and resulting in lost revenue.

Prior to development of the RFP, it would be helpful for the City to obtain a measurement of the quantity of non-recyclables contained in materials it collects and delivers to WMRA under the current contract. This would form a baseline value for performance.

A performance test would be witnessed by a City representative, either staff or a consultant, another common practice for such contracts. The test report with the results would require approval by the City prior to facility acceptance.

6. Service Agreement during Operations - To more clearly identify the performance requirements that the City would impose on the contractor, those requirements should be written into a Service Agreement. The Service Agreement would specify requirements of the contractor during construction of a new facility, if applicable, and operating requirements that would be imposed during the entire term of the service. A draft Service Agreement would be prepared with input from the Environmental Services Department, the City Purchasing Department, and City legal counsel. The balance of items in this section would be recommended for inclusion in the Draft Service Agreement, which would be made a part of the RFP document issued to potential proposing contractors.
7. Marketing Plan - The contractor would be required to submit a detailed marketing plan with the proposal. Based on the City continuing to use glass at the Los Reales Landfill, the City should quantify annual consumption at the Landfill and include in the RFP a commitment for not more than that quantity. Contractors offering proposals would be responsible for marketing the balance of glass quantities.

Marketing requirements should specify that materials are to be marketed. During each operating year of the Service Agreement, the contractor would be required to update and submit to the City the Marketing Plan prior to the beginning of each year. The contractor should be required to state market development efforts expected during the coming year as a means to provide evidence of the contractor's ongoing capability to successfully market the City's materials. Also, the contractor should provide a financial risk discussion on each ongoing or potential market.

8. Compensation - Due to demand for recyclable paper by several paper mills constructed since 2000 in Asian countries, paper prices offered by markets have been high for the last few years. Other commodity prices have also been high. However, during 2008, prices have started to decrease.

The RFP should require a fee and revenue share such that as long as material revenue share exceeds the fee, similar to the City's current situation, the City makes no payment, thereby avoiding an annual budget line item, and the contractor pays the City according to formulas in the Service Agreement. Should costs exceed revenue, the City would have to pay the Contractor. Effects of inflation should be allowed in the fee, and proposing contractors should be required to cite the basis for annual inflation, so that fee increases can be easily calculated and reasonably projected for budget purposes.

The RFP should suggest that the City would be amenable to a compensation structure that would allow the contractor to pay all costs and provide for a nominal profit even if material market conditions significantly deteriorate. Such a condition should be contingent upon the contractor providing detailed cost data and executing the Marketing Plan.

9. Reporting - In addition to the Marketing Plan, the RFP should require reporting several operating parameters, including hours of operation and others, in addition to quantities processed and revenue.
10. Residue Disposal - The City should specify terms by which it would provide landfill disposal capacity for MRF residue. A fee for disposal or no fee structure is feasible. An approach to provide no-fee disposal up to the maximum guaranteed residue rates would be reasonable, accompanied by a fee structure for quantities exceeding the guaranteed level. Other penalties for exceeding the maximum guarantee level would be specified elsewhere in the Service Agreement.
11. Capital Repair - To ensure the long-term viability of the Facility, process equipment and vehicles must be adequately maintained. Certain smaller expenses are required as they occur and manufacturer's preventive maintenance should be conducted each year. However, other larger, capitalized expenses occur at large intervals, such as three years, five years or more, that are required to maintain the equipment's performance. A plan for capital repair schedule should be a proposal requirement. The Service Agreement should require that it be updated each year, including a report on items and their cost that were replaced during the year, as part of a year end report.
12. Continuous Monitoring - The City would want rights to monitor the performance of the Facility on an ongoing basis, with rights to come on site daily, at the City's discretion. The City has this ability with its current contractor, under an informal agreement.
13. Additional Materials - The RFP should specify the process that the City would want to use to add any new material(s) to the program. Additions would be a negotiated revision to the Service Agreement. Acceptance of materials from non-City sources should benefit the City in the form of higher revenue sharing.  
  
Proposals should specify how the contractor would modify the system in the future. Included in this item would be assurances that system components will be designed to accommodate certain specified types of modifications at reasonable costs.
14. Event of Default - The RFP should specify in detail all of the events of default that are common with MRF RFPs. This section provides the understanding of conditions that the contractor must "fix" in order for the contractor to continue meeting the City's expectations and continue serving the City. Examples are overnight storage of incoming materials (due to unavailability of processing capacity), failure to meet residue or other Performance Standards, failure to market materials, and others.
15. Los Reales Landfill Site - For a MRF constructed at the Los Reales Landfill site, the RFP should state the requirement of the City or its representative or consultant to have oversight and judgment regarding acceptability of work as it pertains to use of the site, such as the site plan, utilities, building, and possibly others.

## **VI. CONCLUSIONS AND RECOMMENDATIONS**

The City of Tucson faces a significant decision for its recycling program. With its contract for processing and marketing services set to expire on June 30, 2010, and the ability of the City to extend this contract only for an additional two-year period, i.e. to June 30, 2012, the City would need to develop and conclude a contract to replace it prior to these times. In this section, conclusions developed from this study and recommended approaches and actions for the City are presented.

### **A. Existing Marketplace**

There appears to be little interest from Pima County unincorporated areas and other municipalities in the surrounding region; therefore, planning for significant quantities from other sources is not necessary.

### **B. Recyclable Processing Needs**

Processing for current quantities of recyclable materials, slightly less than 47,000 tons per year, growing with expected population growth, should be the baseline for MRF services to replace the City's contractor at the end of the contract. Quantities collected by Pima County's drop-off system, now less than 1,700 tons per year, represent less than five percent of quantities generated by the City sponsored system. County-collected quantities are not part of the City's system but could be added at any time. Quantities from other municipalities within Pima County are similarly feasible to add to the City's system at any time.

### **C. Area MRFs**

Two of the three MRFs visited in this study (WMRA and Hudson Baylor) are located on a limited acreage site. Nonetheless, as the two facilities visited demonstrate, they can be successful. Lowered process system revision flexibility, limited loading of outgoing product and on-site storage of loaded trailers, limited tipping floor storage capacity, and possibly other, but more minor, constraining effects would be expected with any MRF constructed on a small site. The GBB team recommends that the site have five acres or more to avoid these constraints, as well as to accommodate significant growth in the future.

Each of the three companies visited have capabilities to provide MRF services for the City. Should WMRA propose to provide services after their contract expires, the company may either offer services at their existing site or at a new, as yet, not identified new site. Friedman would offer a new site, commensurate with their plans to vacate a leased site in Tucson currently used for commercial recycling processing. Hudson Baylor would offer a new site as the company does not have operations in Tucson. Each company expressed willingness to use the City's site at the Los Reales Landfill, although it is noted that land available with proper zoning at other locations could also allow the private companies to identify and secure other sites.

GBB Project Team Conclusion Regarding Existing MRFs

Based on visual inspection of the processing equipment and observation of plant operation of the three MRF facilities that the GBB team visited, it is the opinion of the GBB team that the WMRA MRF in Tucson and the Hudson Baylor plant in Scottsdale possess the technological capability and processing capacity to accept and process the material from the City. The Freidman MRF in Phoenix, although it consists of new equipment and had demonstrated more efficient operation, will not be capable to process single-stream material with its current system that is primarily designed to handle clean commercial paper supplies. A substantial redesign of its current system with the installation of new material separation equipment such as screens, magnets, ECS and optical sorts, among others, would have to be undertaken to process single-stream material.

WMRA is currently under contract with the City and will continue to process material from the City through June 2010, with the potential to provide services through June 2012. Beyond this period, based on the general condition of certain conveyors and process equipment, the plant should undergo a major system retro-fit. Optical sort equipment needs to be added to enhance material recovery, and the pre-sort station should be expanded to recover bulky metals and plastic films as recoverable items. The tipping building enclosure needs to be expanded to protect the material from rain and material blown off the property, particularly on windy days. Based on the current layout of the system and space constraints of the site, it would be difficult to implement expansion of the tipping building and provide extension for the pre-sort station.

The Hudson Baylor MRF is observed to be better equipped with the installation of optical sort equipment to process Tucson material as the system employs greater automation for increased capacity and product quality. Assessment of the conveyors and equipment reveal light- to medium-duty construction manufactured by Machinex Company of Canada. The system utilizes two single-ram balers as manufactured by Bollegraaf. The system is expected to continue its current two-shift operation for another five to seven years with regular maintenance. However, if Tucson material is added to its operation on a third-shift schedule, it is anticipated that the existing equipment will experience more rapid deterioration due to extended operating hours on a daily basis. Other factors, such as material stockpiling out of the tipping floor due to inadequate capacity, may impede maneuverability of delivery trucks to unload materials and the lack of dock capacity to continuously ship material out to market due to inadequate storage area in and around the facility.

#### **D. Estimates of Future MRF Service Fees**

Presented in Table VI-1 is a summary of historical WMRA net service fees, GBB's estimate of service fees for obtaining MRF services in Phoenix, and net service fees under three different revenue estimates for a publicly owned MRF for current quantities, escalating with City population growth. This publicly owned MRF scenario is assumed to be on the Los Reales Landfill site owned by the City (from Table IV-7).

Life-cycle projections indicate that, when making a comparison of either of the lower end of the WMRA pricing history or a system of shipping recyclable materials to a MRF in Phoenix (also using the lower pricing history), to the low revenue projections from a City-owned MRF, either private capacity system appears to be less expensive. When the same comparison is made among private capacity and a City-owned MRF for 50 percent higher

quantity, while economics for the City-owned MRF are improved, private capacity appears again to be less expensive.

**Table VI-1 – Summary of Estimated Service Fees  
 from Private MRFs in Tucson and Phoenix (2008\$)**

<b>MRF Location</b>	<b>Cost to Transfer to Phoenix (\$ per ton)</b>	<b>Net Revenue Received (Paid) at MRF (\$ per ton)</b>
WMRA in Tucson	N/A	(\$8.35) to \$32.55 <sup>1</sup>
Other Private in Phoenix	(\$36.84)	(\$45.19) to (\$4.29) <sup>1</sup>
City MRF Low Revenues	N/A	(\$109) to (\$100)
City MRF High Revenues	N/A	(\$43) to \$27
City MRF Average Revenues	N/A	(\$76) to (\$37)

Note:

1. Source: Table III-1.

## **E. Request for Proposals (RFP) Process**

Due to the City's requirements for contracting with a private company for services and with the need for MRF services to be contracted on a long-term basis (for a period of time equal to the service contract period) a well-developed RFP, including a Draft Service Agreement, is recommended to ensure that the City obtains the desired performance over the life of the contract. An RFP that sufficiently addresses current needs and future contingency events could offer a contract for a seven-year or more period, similar to other jurisdictions' experience of up to 20 years. Informal expressions of interest in constructing a MRF in Tucson obtained by GBB from each of the three private contractors provides support for this approach being feasible for the City's system.

One performance aspect of MRF operations is residue quantities. It is recommended that the City request its current contractor to conduct sorting analyses of residue quantities to identify proportions of non-recyclable materials present in loads delivered by the City to the MRF. An alternative approach would be for the City to conduct sorting analyses of loads delivered by the City prior to their being handed over to the contractor, either at a City site or at the contractor's site.

### GBB/RRT Recommendation

The City currently generates approximately 47,000 tpy of recyclable material. This amount will grow considerably - as population grows and commercial accounts increase, and if participation of neighboring towns becomes a reality - and the ability of an existing MRF to cope with growth will be limited.

Thus, it is in the interests of the City to engage a private MRF operator to build and operate a MRF that will handle recyclable material from the City on a service fee formula basis, similar to that currently being used, under a long-term contract. This approach will provide design flexibility to the MRF to implement expansion for future growth and help assure ongoing access to end users of recyclable materials.

Given the economic analysis review above and the schedule needs (having a new contractor in place for at the latest June 2012), pursuing a City-owned MRF is not recommended. Therefore, there is no need for the City to provide a site for the MRF as well. For other MRF contractors not currently located in Tucson or other Arizona cities within reasonable transportation range, they will have to find their own site or pass on responding to a City procurement. GBB/RRT expects that proposals from existing MRF owner/operators, especially those located in Tucson, can be expected to offer the most attractive pricing. Development of a new long-term contract, to provide for MRF services beginning on July 1, 2012, should be accomplished through an RFP process. The three firms reviewed for this Feasibility Study should be invited as should other MRF contractors operating in Arizona and elsewhere. Such firms include: Abitibi, Allied, Casella, Greenstar, Pratt, Republic, Smurfit, and Weyerhaeuser - to name a few, in case they have future interest in the Tucson market.