Materials Recovery Facility Evaluation

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Acronyms and Abbreviations

A&E	Architecture & Engineering
CCH	City and County of Honolulu
County	County of Kaua‘i
DBC	Deposit Beverage Container
ft	Feet/Foot
FTE	Full-Time Equivalent
FY	Fiscal Year
HDPE	High-Density Polyethylene Plastic (#2)
HDR	HDR Engineering, Inc.
HI-5	Hawai‘i Deposit Beverage Container Program
H-POWER	Honolulu Program of Waste Energy Recovery
Kekaha Landfill	Kekaha Municipal Solid Waste Landfill
kW	Kilowatt
Mob/demob	Mobilization/demobilization
MRF	Materials Recovery Facility
MSW	Municipal Solid Waste
No.	Number
OCC	Old Corrugated Cardboard
O&M	Operation & Maintenance
PET	Polyethylene terephthalate Plastic (#1)
ROM	Rough Order of Magnitude
RTS	Refuse Transfer Stations
sq ft	Square Feet
SWD	Solid Waste Division
tpd	Tons Per Day
tph	Tons Per Hour
tpy	Tons Per Year
TRP	The Recycling Partnership
US	United States

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Executive Summary

The County of Kaua‘i’s (County) Department of Public Works, Solid Waste Division (SWD), is responsible for administrating solid waste management programs and policies on the island of Kaua‘i. The limited remaining disposal capacity of the Kekaha Municipal Solid Waste Landfill (Kekaha Landfill) and length of time required to successfully permit a new landfill necessitates the County to evaluate and pursue waste diversion initiatives to preserve landfill waste capacity. To increase island-wide recycling and landfill diversion, the County is considering the implementation of a single-stream recycling curbside collection program for residents serviced by the refuse collection program. Implementing a residential recycling curbside collection program will require the County to develop and operate a materials recovery facility (MRF) on Kaua‘i or contract MRF-processing services to a third-party vendor located on- or off-island.

The objective of this *Material Recovery Facility Evaluation* (evaluation) is to outline conceptual development assumptions, estimate rough order of magnitude (ROM) capital and operation and maintenance (O&M) costs, and assess key factors related to the development of a MRF for integration into the County’s solid waste management program. The information presented in this evaluation is intended to support decision-making regarding the feasibility and recommended approach for processing recyclables if a single-stream recycling curbside program is implemented.

This evaluation considers a single-stream MRF to accommodate residential recyclables captured by a County-implemented recycling curbside collection program (excluding glass) and recyclables from a reduced number of recycling drop-off locations (HDR, 2025). It also includes commercial and residential recyclables currently collected by a third-party contractor under agreement with the County, as well as additional commercial quantities that are being landfilled and could be captured in a single-stream commercial collection program. Based on these existing and potential future recycling programs, it is estimated that approximately 14,055 tons of recyclables would be processed annually, with 11,946 tons of recyclables recovered as marketed commodities, beginning in FY2029 (the assumed program start date, if implemented).

The conceptual design of the MRF is based on key assumptions related to equipment processing capacity, building size, ancillary structures, utility requirements, and roadway access. Standard single-stream recycling equipment was evaluated to sort five primary commodities, including old corrugated cardboard (OCC), mixed paper, tin/steel and aluminum containers, and mixed plastic containers. The estimated development timeline for the MRF ranges from 44 to 57 months, depending on factors such as land acquisition, the selected contracting approach, and the complexity of the permitting process. Table ES1 summarizes the concept design assumptions considered in this evaluation.

Table ES1. Evaluated MRF Considerations	
Assumption	**Quantity/Size/Rate**
Recyclables To Be Processed (FY2029)	14,055 Tons
Start-Up Processing Rate	55 Tons Per Day
Processing Schedule	255 Operating Days Per Year
Equipment Rating	6.9 Tons Per Hour (Minimum)
Total MRF Building Size	40,000 Square Feet (sq ft)
Site Located in Līhuʻe	3-Acres, Agricultural/Industrial-Zoned Land

In addition to developing a MRF, an alternative option was evaluated in which the County's recyclables would be shipped to the island of Oʻahu for processing by the City and County of Honolulu's (CCH's) contracted third-party recycler. This "bale and ship" option would require adjustments to the MRF development and operational assumptions, including the following:

- Development of a smaller facility (approximately 18,500 sq ft) designed to receive recyclables and transfer baled commingled materials and loose, crushed glass into 40-foot shipping containers for transport.
- Installation of two balers and a glass crushing system to process the estimated volumes of commingled recyclables and quantity of glass currently collected through the County's recycling program.
- A simplified processing system would reduce the need for County operations staff.
- Residual materials would be disposed of at the CCH's Waimānalo Gulch Sanitary Landfill (WGSL) or returned to the County for disposal at the Kekaha Landfill.

The economic feasibility of developing a MRF or baling and shipping the recyclables to Oʻahu depends on several factors, including capital costs, O&M costs, and revenue generated from the sale of recovered commodities to end-markets. The cost estimates developed for this evaluation are based on ROM capital and O&M costs derived from comparable mainland MRF facilities, adjusted for Hawaii-based construction and labor rates.

Capital cost estimates include land acquisition, civil site work, buildings and associated infrastructure, and equipment procurement. O&M cost estimates include labor, maintenance, utilities, ground transportation to and from the ports, shipping, and disposal of residual materials.

Based on the assumptions described above, capital and O&M costs were estimated for each option and are summarized in Table ES2. Processing costs for the County's existing recycling program are also shown in Table ES2.

Table ES2. Processing Cost Comparison (FY2029)			
	MRF Development	Bale and Ship	Current Program[1]
Category	Annual Cost or Revenue		
Total Capital Cost	**$57,223,000**	**$22,587,000**	**$0**
Land and Building Debt Service Cost	$2,790,000	$1,410,000	$0
Equipment Debt Service Cost	$2,911,000	$652,000	$0
Total Capital Debt Service	**$5,701,000**	**$2,062,000**	**$0**
O&M Cost	$7,189,000	$4,621,000	$0
Third-Party Processing	$0	$2,621,000[1]	$2,274,000[2]
Total O&M and Debt Service Cost	**$12,890,000**	**$9,340,000**	**$2,274,000**
Commodity Revenue	($1,006,000)	($0)	($0)
Eliminate Third-Party Recyclables Processing Contract[2]	($1,097,000)	($1,097,000)	($0)
Reduce Drop-Off Locations Contract[3]	(589,000)	($589,00)	($0)
Net Annual Processing Cost	**$10,198,000**	**$7,654,000**	**$2,274,000**
Recyclables Processed (tons)	**14,055[4]**	**14,055[4]**	**7,376[5]**
Net Cost/Ton	**$726**	**$545**	**$309**

Notes:

[1] Commodity revenue sharing between CCH and its third-party recycler is through adjustment of the processing fee based on fluctuations in commodity pricing (reviewed every six months). CCH reported the third-party processing rate fluctuated from $225 to $152 per ton over the past 12 months due to improved commodity prices. An average rate of $189 per ton is used in the O&M cost estimates.

[2] The current annual cost of the contracted third-party recycling program is $2,274,000. The total annual costs to manage the drop-off locations and commercial recyclables is $1,177,000 and $1,097,000, respectively.

[3] The cost to manage half of the drop-off locations is 50% of $1,177,000 ($589,000; rounded).

[4] Assumes 14,055 tons of recyclables are processed and 11,946 tons are recovered, annually.

[5] Estimated total residential and commercial recyclables that would be recovered in FY2029 for the current recycling program (third-party contracted services; assumes FY2024 quantities are increased annually by 1.29%).

When comparing the costs to develop a MRF versus baling and shipping recyclables to the island of O'ahu (as shown in Table ES2), the bale and ship option appears to be more cost-effective. In addition to cost considerations, processing recyclables on O'ahu would generate additional residual waste that would require disposal, either at CCH's WGSL or by shipping it back to the County for disposal at the Kekaha Landfill. However, similar to the Kekaha Landfill, WGSL has limited remaining capacity. As a result, the CCH may prefer to preserve that capacity for O'ahu's disposal needs and avoid potential public opposition to accepting off-island waste.

Other comparison factors between the two options include:

- The County would have full control over a County-operated MRF and would not be dependent on the performance and long-term stability of a third-party, off-island operator.
- A County-operated MRF could be expanded as needed to accommodate future increases in recyclable quantities, providing more flexibility for long-term planning and growth.
- The County would own the MRF after the 20-year investment period.
- The known annual O&M cost for a County-operated MRF are expected to remain relatively stable each year. In contrast, third-party processing, shipping, and ground transportation costs could vary significantly due to fluctuations in commodity revenue, fuel prices, residual disposal costs, and contract terms.
- Depending on the need for additional permitting and/or environmental studies for the shipping component, the bale and ship option may have a shorter development timeline, as the third-party MRF on O'ahu is already in operation.

In Table ES2, comparing the costs of developing a MRF with those of the existing recycling program poses challenges. The current program relies on third-party contracted services to maintain the drop-off locations and transport recyclables to a contractor-operated MRF. However, the contractor may not be able to accommodate the projected increase in recyclables without significant equipment upgrades and facility expansion. These improvements would likely result in higher capital and O&M costs and service fees.

For development and operation of a MRF facility, multiple contracting approaches are available to the County dependent upon the County's ownership and control preferences. These contracting approaches include:

- Design-Bid-Build – The County contracts engineering services to design and permit a project and then completes construction through a competitive bid process.
- Bid-Design-Build – The County contracts services to a single contractor who is responsible for the full development of the project (design, permitting, and construction).
- Bid-Design-Build-Operate & Maintain – The County contracts services to a single contractor who will also operate and maintain the facility after construction completion.
- Bid-Design-Build-Finance-Operate & Maintain – The County contracts services to a single contractor who will provide partial or full funding for the facility and will maintain a majority or complete control of the facility.

Each option presents various levels of risk that must be carefully considered, including the types and quantities of materials received at the MRF, the facility's operational performance and long-term maintenance requirements, and marketability of recovered commodities. A public-private partnership with a third-party operator and investor may offer the most cost-effective solution; however, the success of such an arrangement depends on a well-structured contract that clearly defines responsibilities, performance expectations, and operational requirements.

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1 Introduction

1.1 Background

The County of Kaua'i's (County) Department of Public Works, Solid Waste Division (SWD), is responsible for administrating solid waste management programs and policies on the island of Kaua'i, including the expansion of existing and the planning of new solid waste disposal and handling facilities, research, planning, and management of source reduction, recycling, special waste management, and public education/awareness programs. The programs and policies are interconnected to maintain the island's solid waste management system. Key components of the County's existing solid waste management system include refuse collection, refuse transfer stations (RTS), and source reduction, recycling facilities, and programs that are integrated with the County-owned and -operated Kekaha Municipal Solid Waste Landfill (Kekaha Landfill).

The Kekaha Landfill, an important component of the County's current solid waste management system, has an estimated remaining capacity of approximately three years at current rates of waste disposal. The limited disposal capacity and length of time to successfully permit a new landfill (estimated 10-year timeframe) require the County to evaluate and pursue waste diversion initiatives to preserve waste capacity at the Kekaha Landfill. One alternative is to evaluate the implementation of a single-stream recycling curbside collection program to divert additional recyclables in the residential municipal solid waste (MSW) stream that are currently being landfilled. Implementing a residential recycling curbside collection program will require the County to develop and operate a materials recovery facility (MRF) on Kaua'i or contract MRF-processing services to a third-party vendor located on- or off-island.

1.2 Evaluation Objective

The objective of this *Materials Recovery Facility Evaluation* (evaluation) is to incorporate estimated residential recyclable types, quantities, costs, and additional information presented in the *Integration Plan for a Single-Stream Recycling Curbside Collection Program* (SSRCC Integration Plan; HDR, 2025) and evaluate conceptual design and siting alternatives for the development of a MRF on Kaua'i, prepare rough order of magnitude (ROM) capital and operation and maintenance (O&M) cost estimates to develop and operate the MRF, assess third-party development and operating contract options, and prepare an estimated schedule to design, permit, and construct the MRF.

1.3 Existing Refuse Collection and Recycling Services

The County's existing curbside refuse collection service is provided to approximately 20,535 residential units and 500 commercial accounts. Apartment buildings and commercial properties are primarily serviced by private haulers. Curbside recycling is currently unavailable to residential properties serviced under the refuse collection program. Recycling

is available to single-family households and multi-family (apartment) residents via drop-off and redemption center locations (drop-off locations) located throughout the County (HDR, 2025).

Currently, the County contracts with a third-party contractor to accept and process commercially-generated recyclables at a processing facility located in Līhuʻe. Under the terms of the agreement, the contractor is required to accept recyclables from commercial generators at no charge, except for Deposit Beverage Container (DBC) glass, for which they may charge up to five cents per pound.

The contractor is also responsible for managing recyclables collected at the County's eight residential recycling drop-off locations. These services include providing drop bins at each location, maintaining and hauling the bins, maintaining the sites, and processing collected recyclables. Recyclables accepted at the drop-off locations include:

- Old corrugated cardboard (OCC)
- Aluminum and metal cans
- Mixed paper (including office paper, food and beer boxes, magazines, catalogs, glossies, phone books, shredded paper, newspaper, and window envelopes)
- Glass jars and bottles
- #1 and #2 plastic bottles and jars

The current average annual contract amounts over a five-year term are $1,097,000 for commercial recycling services and $1,177,000 for residential drop-off services.

Quantities of recyclables recovered by the third-party contractor during Fiscal Year (FY) 2024 are shown in Table 1.1. The quantities include commercial recyclables received at the Līhuʻe MRF (from both commercial generators and the County Office Recycling Program) and residential quantities collected at the drop-off locations.

Table 1.1. Commercial and Residential Recyclables Recovered by Third-Party Contractor (FY2024)

Recyclable Type	Commercial (tons)[1]	Residential (tons)[1]
Corrugated Cardboard	2,724	1,075
Mixed Paper	108	521
Non-HI-5 Glass	337	266[(1,2)]
Aluminum	131	0.16
Steel	-	70
HI-5 Glass	640	-
PET and HDPE HI-5 Plastic[2,3]	256	-
PET and HDPE Non-HI-5 Plastic[3,4]	0.40	41[(1,2)]

Table 1.1. Commercial and Residential Recyclables Recovered by Third-Party Contractor (FY2024)		
Recyclable Type	**Commercial (tons)[1]**	**Residential (tons)[1]**
Total	**4,196**	**1,973**

Notes:

[1] Quantities reported in the County's FY2024 Annual Solid Waste Report to the Mayor. Commercial quantities include materials from both the County Office Recycling Program and third-party contracted commercial services. Residential quantities include materials collected at the drop-off locations.

[2] Breakdown of residential HI-5 and non-HI-5 glass and plastic was not reported for the drop-off locations. Assumed all residential quantities were non-HI-5 glass and plastic.

[3] PET: Polyethylene Terephthalate Plastic (#1)

[4] HDPE: High-Density Polyethylene Plastic (#2)

1.4 Previous Study Reports

1.4.1 2016 CalRecovery Report

Between April 2014 and December 2016, the County contracted CalRecovery to complete a conceptual design for a single-stream MRF at the existing Kaua'i Resource Center (KRC) to increase island-wide recycling and landfill diversion. The single-stream MRF was conceptually designed to handle the following recyclables:

- Residential and commercial source-separated commingled recyclables (paper and containers);
- Commercial source-separated OCC and glass (mixed color);
- Hawai'i HI-5 Program Redemption Center source-separated, individual material types (aluminum cans, mixed and individual PET/HDPE containers, or mixed-color glass containers); and
- Drop-off program source-separated, individual material types.

The conceptual MRF was originally designed to be located at the former Kaua'i Tropical Fruit Disinfection Facility, which was later changed to be located at the KRC property to allow use of the existing site and buildings. The conceptual MRF design was prepared to consider estimated inbound and outbound mass flows, processing equipment and system configurations, and operating conditions (CalRecovery, 2016).

The conceptual design captures an initial processing rate of 15,000 tons per year (tpy) and is intended to operate as follows:

- Separate glass, tin, metal, and plastic containers from the single-stream using a screening operation at the beginning of the commingled processing line and convey the mixture of containers to a temporary storage area for further processing;
- Convey the remaining single-stream material containing paper-rich material onto a horizontal sorting conveyor belt for manual processing;

- Further process the stockpiled containers during a partial operating shift after the commingled paper container sorting was completed. The recyclables would be introduced back onto the horizontal sorting conveyor belt through a "refeed" configuration; and
- Include a separate baler line for densification (baling) of recovered recyclables for shipping and recycling. The baler would also be used to bale source-separated recyclables delivered directly to the facility (e.g., clean OCC and office paper).

The design includes separate tipping floors and storage areas for deliveries of the following:

- Tipping floor dedicated to receiving and storing commingled recyclables;
- Tipping floor dedicated to receiving commercial source-separated OCC;
- Tipping floor dedicated to receiving commercial source-separated glass (mixed color); and
- Tipping floor dedicated to receiving and storing individual, non-fiber material types.

In addition to the construction of the MRF, modifications and improvements of the existing structures on the KRC property were proposed to enable preservation of an existing conference room, office, and mezzanine. A new above-ground vehicle weigh scale, relocated green waste drop-off area, area for receiving and processing hazardous waste and electronics, and a recyclables drop-off area were also proposed on the site.

The overall enclosed footprint of the single-stream MRF was estimated to be approximately 27,000 square feet (sq ft). The capital and annual O&M costs of the proposed MRF with a refeed processing configuration was estimated to be $10,900,000 and $1,505,000, respectively. A processing rate of approximately 7 tons per hour (tph) was determined based on a five-day, eight-hour processing schedule and 36 tons per day (tpd) of recyclables were estimated for baling. Additional details regarding the conceptual design and processing of the single-stream MRF, proposed to be located at the KRC location, are provided in *A Conceptual Design for Single Stream Materials Recycling Facility (Clean MRF) at the Existing Kauai Resource Center* (CalRecovery Report; CalRecovery, 2016).

1.4.2 2029 Residential Recycling Curbside Collection Program

The feasibility of developing and operating a single-stream MRF is dependent upon the quantity of recyclable material that will require processing at the MRF. The estimated Fiscal Year 2029 (FY2029; an assumed program start date if implemented [refer to the schedule in Section 6]) quantities of recyclables that could be captured by a County-wide residential recycling curbside collection program and delivered to a MRF for processing were evaluated and presented in the SSRCC Integration Plan (HDR, 2025). Quantities of recyclables are summarized in Table 1.2. These quantities do not include an anticipated contamination rate of materials received at the MRF, which will reduce the actual quantities recovered.

Table 1.2. Estimated Quantity of Recyclables Captured by Residential Curbside Collection Program (FY2029)	
Recyclable Type	**Total Curbside Quantities (tons)[1]**
Corrugated Containers	1,572
Mixed Paper	2,002
PET Containers, HI-5	91
PET Containers, Non-HI-5	79
HDPE Containers, HI-5	46
HDPE Containers, Non-HI-5	147
Tin/Steel Cans	197
Aluminum Cans, HI-5	68
Aluminum Cans, Non-HI-5	23
Total	**4,225**

Note:

[1] Assumes a 60 percent capture rate and quantities from half of the existing County drop-off locations. Assumes HI-5 and non-HI-5 glass are not collected in the residential recycling curbside collection program. Refer to other assumptions included in the SSRCC Integration Plan (HDR, 2025).

2 Estimated MRF Process Quantities

To design and develop a single-stream MRF, it is important to understand the anticipated quantity of recyclables (feedstock) to be processed by the facility. Table 2.1 summarizes the estimated total quantities of recyclables expected to be processed and recovered in FY2029 by a County-implemented MRF. This includes recyclables captured through a County-implemented residential curbside collection program and reduced number of recycling drop-off locations (HDR, 2025), commercial recyclables currently recovered by the County's third-party contractor, and additional commercial quantities that are being landfilled and could be captured in a single-stream commercial collection program (refer to Section 1.3).

For purposes of this evaluation, only HI-5 and non-HI-5 glass quantities currently processed by the County's third-party contractor were included in the processing quantities due to the marketability value and the special considerations described in Section 3.1.3. A breakdown of the quantities shown in Table 2.1 are included in Appendix A.

Table 2.1. Estimated Quantities of Processed and Recovered Recyclables (FY2029)					
Recyclable Type	Residential Single-Stream Curbside Collection Program (tons)[1]	Drop-Off Locations (tons)[2]	Commercial Recyclables Processed (tons)[3]	Commercial Single-Stream Recycling Program (tons)[4]	Total (tons)
Corrugated Containers	1,572	574	3,420	1,070	6,636
Mixed Paper	2,002	278	137	1,916	4,333
PET Containers, HI-5	91		160	124	375
PET Containers, Non-HI-5	79	11	0.3	74	165
HDPE Containers, HI-5	46		160	25	230
HDPE Containers, Non-HI-5	147	11	0.3	124	282
Glass Bottles and Containers – HI-5			805		805
Glass Bottles and Containers – Non-HI-5		142	421		563
Tin/Steel Cans	197	38		100	334
Aluminum Cans, HI-5	68			50	118
Aluminum Cans, Non-HI-5	23	~0.1	164	25	212
Total Processed Recyclables[5]	**4,225**	**1,054**	**5,268**	**3,508**	**14,055**
Total Recovered Recyclables[6]	**3,591**	**896**	**4,477**	**2,982**	**11,946**

Notes:

[1] Estimated quantity of residential recyclables from the SSRCC Integration Plan [(HDR, 2025); excluding HI-5 and non-HI-5 glass]. Refer to Table 1.2.

[2] Quantities represent material that would be received at half of the current drop-off locations that would remain open if a residential recycling curbside collection program were implemented by the County.

[3] Total recovered quantity includes those reported in the County's FY2024 Annual Solid Waste Report to the Mayor for commercial recyclables and the County Office Recycling Program. Quantities are inflated 1.29% per year to estimate FY2029 quantities. An assumed contamination rate of 15% is applied to the reported quantities to estimate the amount of material processed by the County's third-party contractor.

[4] Estimated quantities of recyclables in the commercial MSW disposed at the Kekaha Landfill. An assumed capture rate of 60% is applied to the landfilled quantities. Excludes HI-5 and non-HI-5 glass.

[5] Excludes HI-5 and non-HI-5 glass in the residential and commercial waste that is disposed of at the Kekaha Landfill. Only clean glass currently collected by in the County's residential and commercial program is assumed processed at the MRF (i.e., the single-stream recycling curbside collection program excludes glass). #3 through #7 plastics have also been excluded from this MRF evaluation.

[6] An assumed contamination rate of 15% is applied to the total processed quantities to determine the total recovered recyclables.

3 MRF Conceptual Design & Siting Alternatives

3.1 MRF Equipment Technologies

MRFs are designed to process heterogeneous materials and produce end products that are clean and marketable. There are several different types of MRF configurations which vary on how recyclables and waste are collected and handled. A clean MRF accepts recyclables that have already been separated at the source by the consumer. Source separation is termed "single-stream" if all recyclables are commingled in one collection bin (i.e., OCC and paper [fiber materials] and containers are combined) and "dual-stream" if the material is further separated by the consumer into separate collection bins (i.e., fibers and containers are separated). A dirty MRF processes mixed municipal waste. A single-stream clean MRF is considered for this evaluation to accommodate a County-implemented residential single-stream recycling curbside collection program described in the SSRCC Integration Plan (refer to Section 1.4.2; HDR, 2025). All references to a "MRF" in this evaluation reference a clean MRF.

Single-stream MRF design typically incorporates: (1) a less-sophisticated (lower-) technology and higher-labor design approach; or (2) a higher-technology and lower-labor design approach. A lower-technology and higher-labor approach has been used in many facilities throughout the United States (US) and is often applied in a manner that allows equipment to be added as the MRF is expanded. An example design approach might start with sorting material using equipment, such as front-end loaders and excavators to "floor sort" high-value, easy-to-sort material (i.e., OCC and paper) that is delivered in bulk to the facility. A manual sorting line with minimal screening is added downstream as the final sorting process. The addition of more expensive, higher-technology equipment is incorporated to manage increasing quantities as different types of recyclables are targeted or route areas are expanded, which increases the operating complexity of the facility.

3.1.1 Standard and Automated Equipment

A single-stream MRF facility is typically divided into a receiving area called a "tipping floor", a sorting or processing area, a baling area, and interim commodity storage and loading area. Figures 1 and 2 show example floor plans for a single-stream MRF that is sized to process 10 tons per hour (tph) or less of recyclables.

Standard equipment at a MRF includes a presort area with an in-feed conveying system, disc screens and other types of sorters, a sorting line to separate paper products, various combinations of magnet separation for ferrous containers and metal, and eddy current separators (ECS) for aluminum cans and other non-ferrous metal. Screens are often used to separate large cardboard and materials from smaller materials, and two-dimensional (2-D) fibers (e.g., OCC and paper) from three-dimensional (3-D) materials (e.g., bottles and cans).

Air separation devices are used in more complex (automated) systems to separate lighter (or less dense) materials from heavy (or denser) materials. Ballistic separators are used to separate various types of 3-D materials from those that are small and/or flat. Optical sorters

are used to separate different types of plastic containers, fiber products, and other materials based on the material's chemical properties, physical properties, color, and other characteristics.

Recyclables received at a MRF are offloaded at the tipping floor and stored until a viable quantity of material is ready to be processed through the system. Lacking significant organic contamination, tipping floors generally allow for two or more days of storage of incoming material. Increased storage time allows more operating flexibility to mitigate short equipment repair outages and special events such as testing or surges in material delivery Floor sorting is often performed at the tipping floor to remove any large materials and contaminants that might jam or damage the sorting line, and to presort clean loads of material that can be directly diverted to a storage area without processing (e.g., metals and clean loads of OCC and paper).

Front-end loader equipment is typically used to load recyclables onto an infeed conveyor to transport the material to the presort area. Infeed conveyors can be equipped with a feeding box that can be filled with feedstock and automatically metered onto the infeed conveyor. In this manner, the operator of the front-end loader can fill the box and not be concerned about keeping the infeed conveyor uniformly filled, which allows more time to manage materials on the tipping floor.

The presort process is normally a manual operation where quality control sorters remove large and bulky recyclables and residue materials that could jam or damage the sorting equipment. Items removed from the presort area include materials such as scrap metal, bulky plastic containers and objects, bags of shredded paper, and other non-recyclable residue such as waxed, wet, or food-contaminated OCC (pizza boxes and similar materials), clothing, and film plastic. OCC can also be recovered in the presorting area or removed at the downstream disc screens. Unopened plastic bags potentially containing recyclables are opened at this location as time allows. For MRFs that use a bag breaker, recyclables placed in plastic bags might also be pulled off this line and sent through a bag breaker with the bag contents sent back into the process. Ideally, bags known to contain shredded paper are removed at the presort area for special handling to reduce "confetti" litter throughout the facility.

The next sorting processes typically use various types of screens to separate glass (if glass is part of the commodity mix) and fines, different types of fiber products, and containers. These screens are moving beds that allow smaller and/or 3-D materials to fall through or down the screen while carrying the larger 2-D materials up and over the screens. Screens can be designed to crush glass and remove fines, separate containers from fiber products, or separate larger and more rigid fiber materials, such as OCC, from smaller and more flexible office paper and newspaper. An example would be to use a primary disc screen to remove most containers, a secondary inclined disc screen to sort higher-quality paper, and a polishing screen to remove mixed paper and residual materials. Air and/or ballistic separation devices can also be used to further separate the materials. The goal of these components is to get the highest possible separation rate of containers and residue from the fiber and,

conversely, of fiber and residue from the containers. The fiber and containers can then each be further subdivided and cleaned as separate streams.

More-modern, higher-technology fiber sorting is often done with optical sorters. Typically, optical sorters are used at facilities that process large quantities of recyclables and can sort the fiber material into "browns" (cardboard and chipboard) from the "whites" (office paper and newspaper). Film plastic is a frequent contaminant in fiber lines, and optical sorters do a thorough job of removing this residue. Optical sorters can reject flattened plastic or metal containers, wood, glass, and other materials that manage to pass over the disc screens.

3.1.2 Commodity Storage and Baling

All sorted commodities are stored/stockpiled in designated bunkers or containerized until enough material is collected to be prepared for shipment. For smaller, lower-cost facilities, bunkers might be push-through types where the commodity falls to the floor between two push walls that are far enough apart for access by a loader. One end of the push walls is at the baler infeed conveyor. After sufficient material has accumulated in the alley, a front-end loader is used to push the material onto the baler infeed conveyor for baling. More-automated systems use a live-bottom bunker to manage captured commodities. These bunkers are different in that the bottom is either a walking floor or a reversible conveyor. After the bunker is full, a door on the end can be opened and the material advanced onto the baler infeed conveyor. Expanded metal or wire bins are sometimes used for storing containers. These bins can be pneumatically filled and thus can be located away from the sorting location, offering more layout alternatives than bunker storage which is generally located directly under the sorting platform. Usually, the bins are located at a point where a bottom hatch can be opened, allowing the contents to fall onto the baler infeed conveyor.

The last step at a MRF is consolidating and densifying (baling) the commodities. Densification is necessary to achieve legal load limits and avoid underweight shipping charges. For most products, a large two-ram or single-ram baler is used for compaction. Paper balers can chop and fluff certain grades of paper before it is baled, and plastic balers can perforate, rip, and/or flatten certain types of plastic containers to ensure that they remain consolidated within the bales. Aluminum and steel cans are generally crushed and baled. Scrap metal is usually shipped loose to a local scrap yard for further processing.

3.1.3 Special Consideration for Glass

Glass can be an important commodity to recover for the following primary reasons: 1) Glass is heavy and thus can increase diversion rates significantly (often making up approximately 10 to 15 percent of the total tonnage for a facility); and 2) Container glass is usually a commodity that residents want to recycle. Excluding glass from a single-stream recycling curbside collection program may decrease participation in the recycling program. Alternatively, including glass in a single-stream recycling program creates several issues that should be considered for MRF processing including:

- Glass is highly abrasive to the MRF equipment and will significantly increase maintenance costs due to added wear and tear of the equipment.

A glass cleanup system is required to remove the light fines, ferrous metal, and smaller material in the crushed glass process. Cleanup systems for glass processed at MRF facilities can vary in cost dependent on levels of sophistication, adding as much as $150,000 to $500,000 additional capital cost for basic removal of lights, fines, some organics, and ferrous metal.

- Color sorting of glass to meet end-user specifications is an additional investment (e.g., glass for fiberglass production). Depending on the end-user specifications, color sorting systems can cost millions of dollars and are generally prohibitively expensive for smaller facilities.
- It is very difficult to keep glass fines from contaminating other recyclable materials, such as OCC, mixed paper, and plastics. Facilities that accept glass typically have a harder time marketing their baled materials at premium rates.
- Glass shards can pose safety hazards to workers, particularly workers on the sorting line if handling contaminated materials.

Glass containers, if accepted as part of the single-stream mix, are normally crushed with a glass-breaker screen and removed from the sort line as early in the process as possible, usually just after the presorting phase. Special glass breaking or crushing screens are used to break the glass into pieces. The crushed glass is collected with items such as corks, bottle caps, rocks, shredded paper, food waste, yard clippings, ceramics, and other fines that are less than two inches in size. Glass cleanup systems can be used to remove lighter fines and ferrous metal, but the glass product is usually a dirty mix of all colors of glass and remaining contaminants. This product typically has a very low commodity value, if any.

Glass can also be collected via a drop-box system (i.e., at the County recycling drop-off locations), where the glass is handled separately from other recyclables, keeping the glass clean and more suitable to process. Drop boxes require residents to handle glass separately and make a dedicated effort to bring the glass to the drop boxes instead of disposing of it in their bins at the curb. This added effort to recycle glass separately may result in a decrease of participation in a curbside program and more reliance on the drop box locations. In addition, many residents will most likely continue to place glass with their general MSW or with other recyclables, and thus not all glass will be eliminated from the MRF sort line. Continued education could mitigate this potential problem but is not likely to eliminate it.

A MRF system is designed to attempt to recover the bottles whole only for those locations where whole glass containers must be recovered for a high redemption value. Today's glass bottles are usually lightweight and very few bottles will survive intact beyond the presort area, possibly ending up as prohibitive materials in the other commodities. For nearly all other commodities, when glass is found in the bales, a discount is applied to the shipment, thereby lowering the value of the commodities (HDR, 2018).

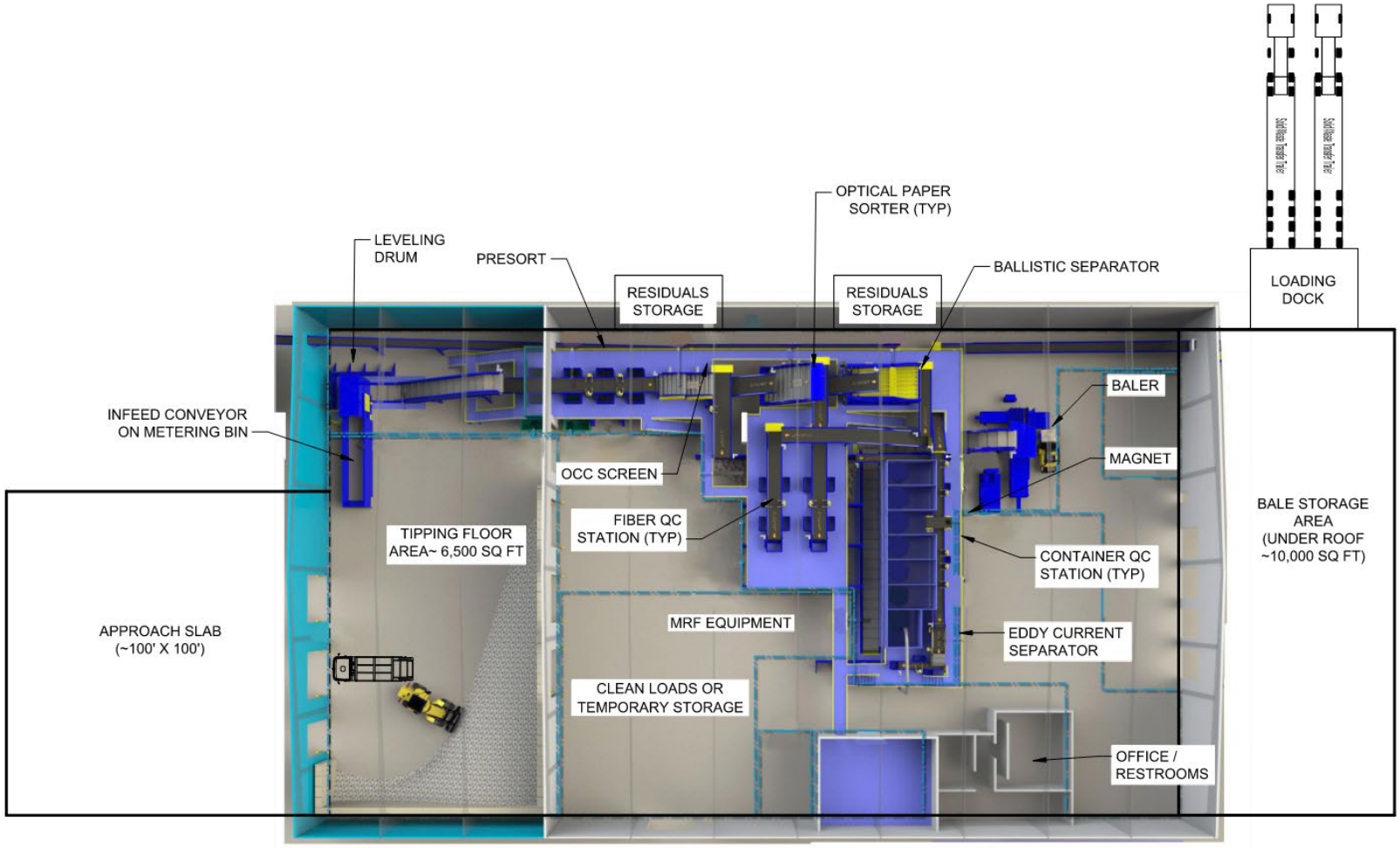

Figure 1. Example 1 MRF Floor Plan (10 TPH or Less)

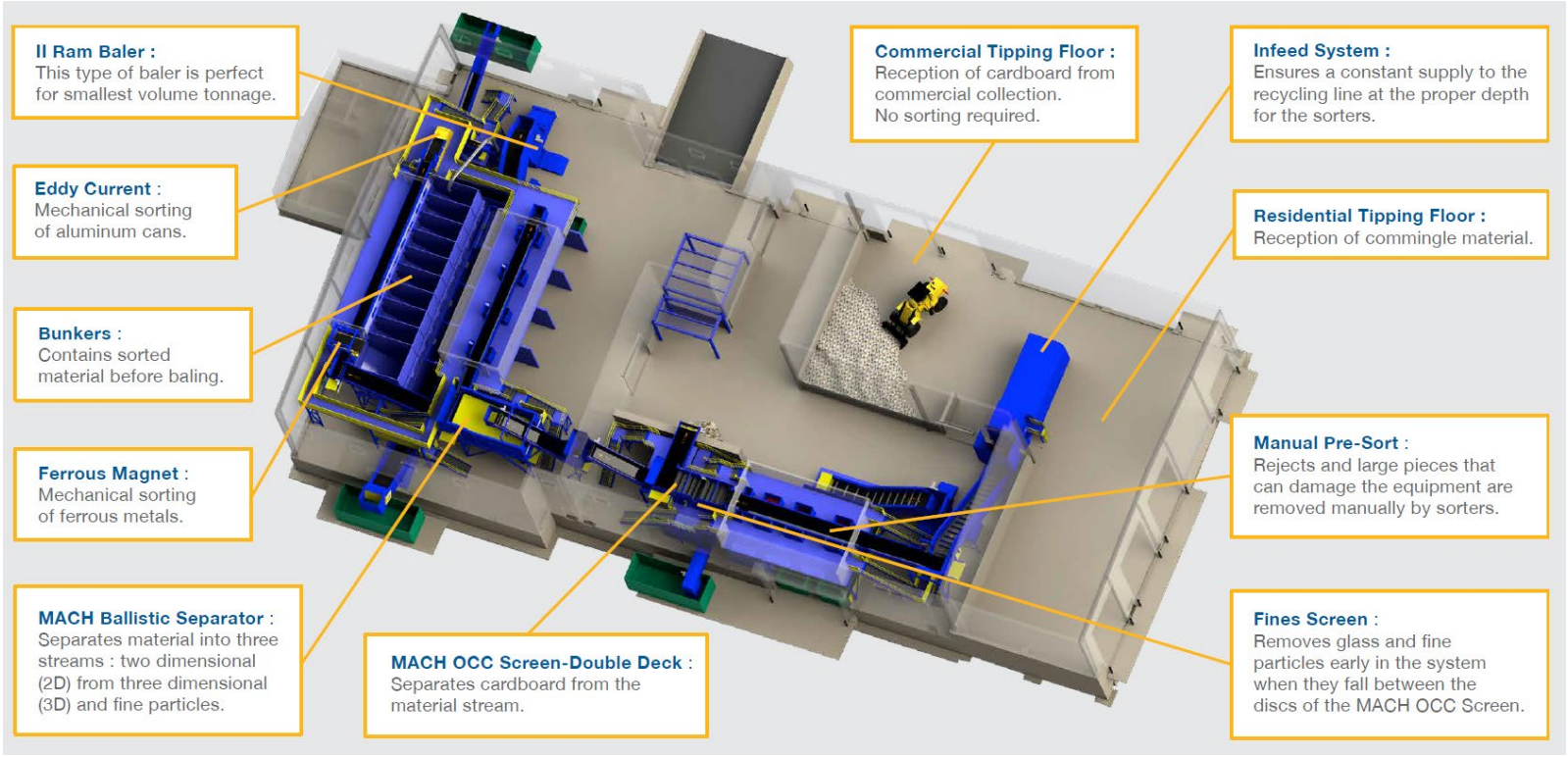

Figure 2. Example 2 MRF Floor Plan[1] (10 TPH or Less)

[1] Floor plan provided by Machinex's *Experience Results with the ECO MRF* brochure https://www.machinexrecycling.com/sorting/sorting-systems/single-stream-recycling/

3.2 MRF Conceptual Design Considerations

3.2.1 Processing Capacity

Several companies supply equipment to separate and process commingled recyclables using varying technologies as described in Section 3.1. Systems are typically sized to process approximately 10 tph or less for smaller systems to 35 tph for larger, more complex systems. As described in Section 1.4.1, CalRecovery proposed a facility start-up processing rate of approximately 7 tph based on a five-day, eight-hour processing schedule using equipment rated for approximately 12 to 15 tph. Thirty-six tons of recyclables were estimated to be baled daily. Based on the updated recyclable quantity estimates described in Section 2, the CalRecovery start-up processing rate, processing schedule, and equipment rating would still be valid for the updated FY2029 quantity estimates (14,055 tpy, 255 operating days per year, 55 tpd, and a minimum 6.9 tph operating rate). Examples of single-stream MRF floor plans that process 10 tph or less are shown in Figures 1 and 2 (included in Section 3.1.1).

Although the planned start-up processing rate (6.9 tph) is lower than the equipment processing rate (10 tph), investing in higher-capacity, automated equipment may offer long-term cost advantages. These include reduced labor requirements to operate the facility, increased capacity to accommodate future growth in recyclable volumes, and greater flexibility to modify or expand standard-sized equipment over time. Furthermore, the costs of a smaller, customized system could offset much of the cost difference when compared with a larger, standard sized system. A detailed cost benefit analysis, considering equipment options and potential labor cost offsets, would be conducted during the design phase to support the County's decision-making process.

3.2.2 MRF Building Size

The MRF building will include a tipping floor, processing area with in-feed conveyors, sorting stations, screens and separators, a commodity baling area, and an interim storage area for baled commodities (refer to Figure 1 in Section 3.1). Tipping floors are typically designed to allow two to three days' worth of storage for inbound recyclables in the event of a facility shutdown and to manage peak-hour surges in material delivery.

Assuming the tipping floor area can hold loose, commingled recyclables to an average height of eight feet (with push walls) and the weighted average density of the recyclables is approximately 150 pounds per cubic yard (excluding glass; as shown in Table 2.1), the minimum required area for two days of storage is approximately 4,950 sq ft. Additional tipping floor space is necessary to accommodate glass processing via a separate hopper, conveyor, and crusher system; provide safe unloading areas for customers; and allow equipment maneuverability. For the purposes of this evaluation, the total tipping floor area is assumed to be 7,500 sq ft. For reference, CalRecovery previously estimated that 6,600 sq ft would be required to support two days of storage capacity.

Sufficient area is also required for managing glass, baling, and temporary storage of commodities. The size of this area depends on the types of materials handled, desired amount of storage time, and flexibility needed to transport commodities to market. Shipping recyclables from the County to interisland, mainland, or international ports requires longer storage times to coordinate ground transportation and align with shipping schedules.

Assuming a four-week storage period for 995 tons per month of processed recyclables (excluding glass), approximately 6,630 sq ft of storage area are needed. This estimate is based on stacking 1,000-pound OCC bales (the primary commodity) 12 feet (ft) high, with bale dimensions of 30 inches wide by 48 inches long by 48 inches high. Additional space is also required for glass storage, equipment maneuvering around the stacked bales, and to access the loading dock(s). For the purposes of this evaluation, the interim storage area is assumed to be approximately 11,000 sq ft. For reference, CalRecovery estimated a required storage area of 6,850 sq ft to support a similar four-week storage period.

The area required for processing equipment depends on the specific type and configuration of equipment selected for the MRF. CalRecovery estimated a processing building area of approximately 22,000 sq ft (100 ft by 220 ft), which includes approximately 8,550 sq ft dedicated to processing equipment. The equipment footprint for the MRF layout shown in Figure 1 is approximately 11,500 sq ft. Additionally, approximately 10,000 sq ft are needed for surrounding space to support temporary storage, processing of clean materials (e.g., glass and OCC), second-run materials, residuals, and an office. For the purposes of this evaluation, a total combined area of 21,500 sq ft has been assumed.

The total area required for the processing building is approximately 40,000 sq ft (total area under roof), which includes the tipping floor, processing equipment area, and interim storage area (as shown in Figure 1).

3.2.3 Ancillary Buildings, Structures, Utilities, and Roadways

Depending on the County's operational needs, additional ancillary buildings and site features are required to support MRF operations. These may include a weigh scale, administrative office, employee and visitor parking, a truck fleet baseyard for curbside recycling trucks, and additional covered or uncovered commodity storage areas. In addition to these buildings, adequate site area must also be allocated for customer queuing and maneuverability at the tipping floor, access for 18-wheel tractor trailers to the loading dock(s), ingress and egress to public roadways, storm water management infrastructure, and landscaping or screening buffers.

The MRF will require 480-volt, three-phase power to operate the large electric motors used in the conveyance and baling equipment. Additionally, an adequate water supply is necessary to support a sprinklered fire protection system as well as a connection to the County's sanitary sewer system. Depending on the location of the existing utility

services, additional site area may be needed to accommodate utility tie-ins, particularly if long service runs or easements are required (e.g., for overhead electric lines).

Considering the aforementioned features, site configuration, and County zoning requirements, an estimated one to two acres of additional land (i.e., in addition to the processing building area) is needed to develop the MRF.

4 Capital and Operating & Maintenance Costs

The economic feasibility of developing a single-stream MRF depends on capital and O&M costs, as well as revenue generated from the commodities sold to end-markets. Estimated ROM capital and O&M costs for developing a single-stream MRF are presented in the following sections. The estimated costs reflect the construction and operation of a MRF with the capacity to process the estimated quantity of recyclables described in Section 3.2.1 (i.e., 14,055 tpy, 55 tpd, or 6.9 tph) and are based on capital and operational costs derived from comparable mainland MRF facilities, adjusted for Hawaii-based construction and labor costs (HDR 2018). A detailed breakdown of the costs discussed in this section are provided in Appendix B.

4.1 Capital Cost Estimate

Table 4.1 shows a summary of estimated ROM capital costs to develop a single-stream MRF. A breakdown of the costs is provided in Appendix B.

Table 4.1. Estimated Capital Cost Summary (FY2029)

Item	Costs[1]
1. Land Acquisition	
Land Acquisition	$4,500,000
Fees (10%)	$450,000
Item 1 Subtotal	**$4,950,000**
2. Site Civil Work	
Mobilization/Demobilization & General Conditions (10% of Costs)	$373,000
Site Work (Excavation/Backfill, Grading, Security, Landscaping, Stormwater Management System, & Miscellaneous)	$1,955,000
Utilities (Water, Sewer, & Electric)[2]	$444,000
Roadways & Parking	$1,325,000
Item 2 Subtotal	**$4,097,000**
3. Building and Other Structural	
Mobilization/Demobilization & General Conditions (10% of Costs)	$1,083,000
Processing Building	$8,500,000

Table 4.1. Estimated Capital Cost Summary (FY2029)	
Item	**Costs[1]**
Office Buildout in Processing Building	$750,000
Other Structural – Approach Slab, Push Walls, Loading Dock, Equipment Foundations, & Miscellaneous	$1,325,000
Weigh Scale	$250,000
Item 3 Subtotal	**$11,908,000**
Items 1 through 3 Subtotal	**$20,955,000**
4. Equipment	
Fixed Processing Equipment[3]	$8,205,000
Equipment Shipping Allowance	$1,000,000
Processing Equipment Installation (40% of Costs)	$3,282,000
Rolling Equipment	$1,060,000
Item 4 Subtotal	**$13,547,000**
Items 1 through 4 Subtotal	**$34,502,000**
5. General Conditions	
Items 1-4 Inflated 3%/Year to FY2029	$5,521,000
A&E[4] Design & Environmental (6% of Items 2, 3, & 4)	$2,401,000
Construction Administration (4% of Items 2, 3, & 4)	$1,601,000
Item 5 Subtotal	**$9,523,000**
Items 1 through 5 Subtotal	**$44,025,000**
Contingency (30%)	**$13,208,000**
Total Capital Cost	**$57,223,000**
Annual Land and Building Debt Service (20 Years at 5%)[5,6]	**$2,790,000**
Annual Equipment Debt Service (10 Years at 5%)[6]	**$2,911,000**

Notes:

[1] Refer to Appendix B1 for breakdown of costs and assumptions.

[2] Utility costs can vary significantly based on availability and tie-in conditions to existing systems.

[3] Includes standard processing equipment as shown in Figures 1 and 2.

[4] A&E: Architecture and Engineering

[5] General Conditions costs (Item 5) are included in the annual land and building debt cost.

[6] Annual debt service for building and equipment life span and interest rate.

4.2 Operation and Maintenance Costs

Table 4.2 shows the estimated ROM annual O&M costs required to operate a single-stream MRF. A breakdown of the costs is provided in Appendix B.

The following FY2024 labor rates used in the recycling curbside evaluation were matched with a corresponding MRF staff position and inflated 3% per year to FY2029:

- Facility Manager/Supervisor ($34.16 per hour) plus fringe benefits ($27.33 per hour).
- Mechanic ($45.67 per hour) plus fringe benefits ($36.54 per hour).
- Equipment Operators ($30.83 per hour) plus fringe benefits ($24.66 per hour) and overtime rate ($16.12).
- Scale Operator and Clerical ($23.97 per hour) plus fringe benefits ($19.17 per hour).
- Sorters ($20.00 per hour) plus employment agency markup ($10.00 per hour).

Table 4.2. Estimated Annual O&M Costs (FY2029)[1]

Category	Quantity	Unit	Unit Cost	Cost[1]
Facility Manager/Operations Supervisor	1	Staff[2]	$148,364	$149,000
Mechanics for Facility & Equipment Maintenance	1	Staff	$198,360	$199,000
Equipment Operators	2	Staff	$133,864	$268,000
Scale Operator & Clerical	2	Staff	$104,052	$209,000
Sorters[2]	8	Agency	$70,992	$568,000
Overtime		% of Labor[2]	20%	$136,000
Miscellaneous Uniforms & Safety per Union Agreement	1	LS	$38,280	$39,000
Total Labor Costs	**16 (FTE)[2]**			**$1,568,000**
Fuel	24,480	Gallon	$8.00	$196,000
Building and Equipment Maintenance		% of Capital	1%	$573,000
Consumables (e.g., Lubricants, Baler Wire, etc.)	14,055	$/Ton	$3.00	$43,000
Utilities	14,055	$/Ton	$10.00	$141,000
Miscellaneous (Insurance, Permits, etc.)		% of Capital	0.5%	$287,000
Commodity Shipping and Ground Transportation	11,946	Tons	$337	$4,026,000
Residuals Transportation and Disposal[3]	2,109	Tons	$168	$355,000
		Total Annual O&M Cost		**$7,189,000**

Notes:

[1] Refer to Appendix B4 for breakdown of costs and assumptions.

[2] FTE – full time equivalent.

[3] Transportation and disposal at Kekaha Landfill.

4.3 Recyclables Commodity Pricing and Potential Revenue

Commodity prices for recyclables may be impacted or fluctuate based on the recyclable types and region that they are marketed to or based on economic factors. For the purposes of this report, low and high commodity prices between 2020 and 2024 were reviewed to capture the varying recycling market prices over time. Prices from Los Angeles[2], California are used to evaluate potential revenues from collected recyclables as California has the most similar US recycling market to the County. Table 4.3 shows commodity pricing (dollars per ton) for the recyclable types discussed in Section 2.

Table 4.3. Los Angeles Recycling Commodity Prices ($/ton)

Recyclable Type	Low/High Prices	2020	2021	2022	2023	2024
	($/ton)					
Aluminum cans	Regional Low Price	$720.00	$960.00	$1,100.00	$1,100.00	$1,200.00
	Regional High Price	$1,000.00	$1,460.00	$2,400.00	$1,400.00	$1,700.00
Steel Cans	Regional Low Price	$90.00	$90.00	$150.00	$150.00	$150.00
	Regional High Price	$125.00	$270.00	$270.00	$185.00	$185.00
Mixed Paper	Regional Low Price	($10.00)	$30.00	($3.00)	$0.00	$25.00
	Regional High Price	$40.00	$105.00	$65.00	$45.00	$65.00
Corrugated Containers	Regional Low Price	$5.00	$60.00	$15.00	$15.00	$35.00
	Regional High Price	$85.00	$140.00	$100.00	$80.00	$105.00
PET Plastic	Regional Low Price	$60.00	$160.00	$120.00	$60.00	$140.00
	Regional High Price	$407.20	$520.00	$520.00	$280.00	$300.00
HDPE Plastic	Regional Low Price	$0.00	$0.00	$20.00	$20.00	$0.00
	Regional High Price	$80.00	$160.00	$240.00	$40.00	$20.00

[2] https://www.recyclingmarkets.net/secondarymaterials/prices.html?cid=3&city=LOS+ANGELES+%28Southwest+USA%29#prices

Table 4.3. Los Angeles Recycling Commodity Prices ($/ton)						
Recyclable Type	Low/High Prices	2020	2021	2022	2023	2024
	($/ton)					
Mixed Glass	Regional Low Price	($60.00)	($60.00)	($60.00)	($60.00)	($40.00)
	Regional High Price	($20.00)	($20.00)	($20.00)	($20.00)	($25.00)

Note:

Commodity prices were obtained from https://www.recyclingmarkets.net/secondarymaterials/prices.html?cid=3&city=LOS+ANGELES+%28Southwest+USA%29#prices. Values shown in parentheses are negative commodity prices.

The commodity prices shown in Table 4.3 are averaged and used to estimate the total commodity revenue for the estimated quantities of recyclables recovered at the MRF.

Table 4.4 combines the annual debt service and O&M costs with the estimated annual revenue generated from the sale of commodities to calculate a net cost per ton required to develop and operate the MRF. The table also includes the reduction in the costs associated with the County third-party contracts for managing the drop-off locations and commercial recyclables. A detailed breakdown of these costs is provided in Appendix B. Appendix C presents the calculations for potential annual revenue from commodity sales.

Table 4.4. Net MRF Processing Cost with Commodity Shipping and Revenue, and Offsetting Cost Reductions (FY2029)[1]	
Category	Annual Cost or Revenue
Total Capital Cost	**$57,223,000**
Land and Building Debt Service Cost	$2,790,000
Equipment Debt Service Cost	$2,911,000
Total O&M Cost[2]	$7,189,000
Total Processing Cost	**$12,890,000**
Total Processing Cost/Ton	**$918**
Commodity Revenue	($1,006,000)
Eliminate Third-Party Recyclables Processing Contract[(3)]	($1,097,000)
Reduce Third-Party Drop-Off Locations Contract[(3)]	($589,000)
Net Annual Processing Cost	**$10,198,000**
Net Processing Cost/Ton	**$726**

Notes:

[1] Assumes 14,055 tons of recyclables are processed and 11,946 tons recovered, annually. Average commodity prices between 2020 to 2024 are used to calculate FY2029 revenues or costs.

[2] Includes ground transportation and shipping costs for commodities to mainland end markets.

[3] Total annual contracted program cost is $2,274,000 for FY2029. Total annual cost to manage the drop-off locations is $1,177,000 and commercial recyclables is $1,097,000. Cost to manage half of the drop-off locations is 50% of $1,177,000 ($589,000; rounded).

5 MRF Development & Operating Contract Options

Various contracting approaches are available for the development and operation of a single-stream MRF facility. The selection of an appropriate approach depends on the level of ownership and control the County wishes to retain, which directly influences the distribution of risks and rewards between the public-private partnership. Generally, as more responsibility is transferred to the contractor, the County's control over the project decreases, and the potential for performance issues and increased project costs rises. While it can be challenging to identify a qualified contractor and establish a fair, enforceable development and operating agreement, a well-structured partnership can contribute significantly to the long-term success of the project.

The following subsections describe the public-private approaches the County may consider in developing and operating a MRF, along with key considerations for each. Shown in Table 5.1 is a comparative matrix of risks and rewards associated with each approach.

5.1 Design-Bid-Build Approach

A design-bid-build (DBB) approach is the most common approach used by the County to procure professional engineering and construction services to complete a project. Under this approach, the County contracts architectural and engineering services to design and permit a project, followed by construction through a competitive bidding process. This competitive bidding process also applies to procurement of MRF processing equipment if the County opts to purchase equipment directly from equipment vendors rather than through a general contractor. Direct equipment vendor procurement allows the County to work with a specific vendor during the design phases, reducing equipment-related design assumptions and minimizing potential design changes during construction.

To develop a MRF using this approach, the County would retain control of the site (either through lease or ownership) and manages the design, permitting, and construction of the entire facility, including processing equipment and infrastructure such as roadways, utilities, weigh scales, existing building modifications, and new buildings. The County can choose to operate and maintain the facility itself or contract those services to a third-party operator. Under this approach, the County assumes all risks and rewards throughout both during the development and O&M phases (refer to Table 5.1).

5.2 Bid-Design-Build Approach

A bid-design-build (BDB) approach is similar to the DBB approach described in Section 5.1, except that the County contracts services to a single entity who is responsible for full development of the project. Under the BDB approach, the contractor is responsible for designing, permitting, and constructing the project based on an agreed-upon scope of work, schedule, and fee.

When developing a MRF using this approach, the County would retain control of the site (either through lease or ownership) and prepare a scope of work and technical and performance specifications that form the basis of the contract documents. These documents typically include drawings completed to the 30 percent design level, as well as minimum technical and equipment performance specifications. The selected contractor would then use these County-issued documents to provide architectural and engineering design, obtain permits, construct the facility, and conduct acceptance testing.

Compared to the DBB approach, a contractor may be more likely to submit a higher bid under the BDB approach due to the increased risk of potential cost fluctuations. These risks may include design uncertainties, material and labor cost fluctuations over a longer project timeline, and design and construction issues within contractor's team. Under the BDB approach, the County shares in both the risks and rewards during the development phase (e.g., design risk is transferred to the contractor, but higher bid costs can lower the County's financial benefit). There is no significant difference between the BDB and DBB approaches during the O&M phase.

5.3 Bid-Design-Build-Operate & Maintain

In a bid-design-build-operate and maintain (BDBO&M) project approach, the contractor is responsible for full development of the MRF, consistent with the scope for a BDB approach described in Section 5.2. In addition, the contractor is responsible for operation and maintenance of the facility following construction completion.

When developing a MRF using this approach, the County would relinquish a significant amount of control of the project during the O&M phase. Therefore, it is very important to establish well-defined contract terms that clearly outline both performance expectations and financial responsibilities. Key elements to address include the service fee structure (e.g., annual lump sum payments and/or fees based on the quantity of recyclables processed), funding responsibility for general maintenance and larger capital improvement projects (e.g., major overhauls, expansion projects, end of life/contract term replacement), minimum staffing and equipment requirements, and terms for commodity handling and revenue sharing.

5.4 Bid-Design-Build-Finance-Operate & Maintain

In a bid-design-build-finance-operate and maintain (BDBFO&M) project approach the contractor provides partial or full funding for the facility, thereby relieving the County of some or all financial responsibility. This approach can be variable in its structure.

When developing a MRF using this approach, the County would transfer a majority or complete control of the facility to the contractor. The contractual terms may be heavily weighted in favor of the contractor, depending on factors such as the actual or perceived risks assumed, the level of financial investment required, site ownership arrangements, and other negotiated terms.

The following table presents a comparative matrix of risks and rewards associated with each of the contracting approaches discussed in Sections 5.1 through 5.4.

Table 5.1. Risk Assignment for Alternative Procurement Approaches

	Procurement Type			
Risk Element	**DBB**	**BDB**	**BDBO&M**	**BDBFO&M**
Capital Cost Risks				
Capital Costs Overruns	County	Contractor/ County[1]	Contractor/ County[1]	Contractor
Additional Capital Investment to Achieve Required Operating Performance	County	Contractor/ County[1]	Contractor/ County[1]	Contractor
Additional Facility Requirements Due to New State or Federal Legislation	County	County	County	County[2]
Delays in project completion which lead to delays in revenue flow and adverse effect of inflation	County	Contractor[3]	Contractor[3]	Contractor
Operation and Maintenance Cost Risks				
Technical Failure	County	Contractor/ County[1]	Contractor	Contractor
Excessive Facility Downtime	County	County	Contractor	Contractor
Underestimation of Facility O&M Requirements (labor, materials, etc.)	County	County	Contractor	Contractor
Inadequate Facility Management	County	County	Contractor	Contractor
Changes in Facility Requirements Due to New State or Federal Legislation	County	County	County	County[2]
Significant Changes in Type and/or Quantity of Recyclables	County	County	Contractor/ County[4]	Contractor
Fluctuations in Commodity Prices and Revenue	County	County	Contractor/ County[4]	Contractor

Table 5.1. Risk Assignment for Alternative Procurement Approaches				
	Procurement Type			
Risk Element	DBB	BDB	BDBO&M	BDBFO&M
Underestimating the Quantity of Contamination/Residuals	County	County	Contractor/ County[5]	Contractor

Notes:

[1] County may be responsible for all or shared costs depending on the scope of work and technical specifications.

[2] Contracts are typically written so that the County maintains full responsibility for changes in legislation.

[3] Assuming the County has met all contract obligations.

[4] Dependent on how commodity handling and revenue sharing is structured in the contract.

[5] Dependent on how residuals and disposal costs are structured in the contract.

6 MRF Development Schedule

The development of a new single-stream MRF will involve identification of a suitable site, acquisition (if needed), design, permitting, construction, and operation. Tables 6.1 and 6.2 show MRF development schedules for a DBB and BDB approach, respectively.

Table 6.1. MRF Development Schedule (Design-Bid-Build)		
Activity	Month	Time to Complete
1. A&E[1] Design and Environmental Consultant Contract Execution	6[(2)]	6 Months
2. Technical Specifications/Performance Criteria	9	3 Months (from end of Activity 1)
3. Geotechnical Report	9	3 Months (from end of Activity 1)
4. Processing Equipment Bid Solicitation and Contract Execution	15	6 Months (from end of Activity 2)
5. Preliminary Design to Support Environmental Permitting Efforts (EA and SMA [if applicable])[3,4]	12	3 Months (from end of Activity 2)
6. 60%, 90%, Construction Level Design and Specifications	20	8 Months (from end of Activity 5)
7. EA and SMA Permit	18	12 Months (from end of Activity 1)
8. Building and Grading Permits	24	4 Months (from end of Activity 6)
9. Construction Bid Solicitation and Contract Execution[5]	26	6 Months (from end of Activity 6)
10. Construction	42	18 Months (from end of Activity 8)
11. Commissioning/Acceptance	44	2 Months (from end of Activity 10)
Total Project Time	**44 Months**	

Notes:

[1] A&E – Architecture and Engineering

[2] Assumes MRF site is identified during this period.

[3] EA – Environmental Assessment; SMA – Special Management Area Permit.

[4] Assumes no significant special land use or zoning changes are required (e.g., State Land Use District Boundary Amendment).

[5] County to determine if processing equipment is purchased directly from equipment vendor or furnished by the construction contractor.

Table 6.2. MRF Development Schedule (Bid-Design-Build)[1]

Activity	Month	Time to Complete
1. Engineering and Environmental Consultant Contract Execution[2]	6	3 Months
2. Prepare Scope of Work and Technical Specifications/Performance Criteria for RFP	12	6 Months (from end of Activity 1)
3. Issue Request for Proposal (RFP)[3]	14	2 Months (from end of Activity 2)
4. Proposals Due	16	2 Months (from end of Activity 3)
5. Technical Review of Proposals and Selection Committee Ranking	17	1 Month (from end of Activity 4)
6. Contract Negotiations	18	1 Month (from end of Activity 5)
7. Design Build Contract Execution	22	4 Months (from end of Activity 6)
8. Preliminary Design to Support Environmental Permitting Efforts (EA & SMA [if applicable])	25	3 Months (from end of Activity 7)
9. 60%, 90%, and Construction Level Design and Specifications	33	8 Months (from end of Activity 8)
10. EA and SMA Permit	37	12 Months (from end of Activity 7)
11. Building and Grading Permits	37	4 Months (from end of Activity 9)
12. Construction	55	18 Months (from end of Activity 11)
13. Commissioning/Acceptance	57	2 Months (from end of Activity 12)
Total Project Time	**57 Months**	

Notes:

[1] See applicable notes from Table 6.1.

[2] Engineering & environmental consultants will assist the County with Scope of Work and Technical Specifications/Performance Criteria, EA and SMA.

[3] Front-end contract documents for the RFP are completed by the County.

7 Transfer, Shipping, and Processing on O'ahu

7.1 Assumptions, and Capital and O&M Costs

An alternative approach to developing a single-stream MRF is shipping the County's recyclables to the island of O'ahu for processing by the City and County of Honolulu's (CCH's) contracted third-party recycler. This "bale and ship" option would require modifications to the MRF development and operational assumptions described in previous sections, including the following:

- A smaller facility to receive and bale commingled recyclables, process glass, and load materials into forty-foot shipping containers for transport.
- Sufficient yard area to maneuver and stage containers until they are ready to be transported to the Port of Nawiliwili.
- Installation of two balers to manage the estimated quantity of commingled recyclables, along with a hopper, conveyor, and crusher system for glass processing.
- Residuals disposal at CCH's WGSL.

Based on these changed assumptions, the estimated ROM capital and O&M costs described in Section 4 were revised to consider the following:

- The required land area is reduced to one acre. The processing building and office will total approximately 18,500 sq ft, allocated as follow: 7,500 sq ft for the tipping floor, 7,500 sq ft for the two balers and glass processing equipment, and 3,500 sq ft for temporary bale storage, office and breakroom, and loading dock.
- Most processing and rolling equipment are eliminated except the loader, forklift, terminal tractor, supervisor truck, two balers with feed conveyors, and glass processing equipment. Approximately 14 forty-foot shipping containers will be required to manage transportation of the recyclables to O'ahu (a minimum of 12 containers for rotation and 2 spares). Ground transportation to and from the ports will be handled third-party contractors.
- Each week, approximately 12 shipping containers will be loaded and transported to the Port of Nawiliwili. This estimate is based on 45 bales of commingled recyclables per container (1,000 lbs per bale, totaling 345 bales per week or 22 tons of cargo), plus loose crushed glass loaded into containers. The current inter-island shipping schedule is twice per week, requiring continued rotation of approximately five to six loaded and empty containers at each port per shipping day.
- Operations staff will be reduced to a smaller team, consisting of one facility manager, three equipment operators (one loader and one forklift operator, and

one equipment operator/attendant), one laborer, and one scale operator or clerical staff.

- The third-party contracted recycler will be responsible for disposing of residuals at CCH's WGSL.

The revised annual capital and O&M, and net costs are shown in Table 7.1 and a detailed breakdown of the costs are provided in Appendix B.

Table 7.1. Net Costs to Transfer, Ship, and Process on O'ahu (FY2029)

Category	Annual Cost or Revenue[1]
Total Capital Cost	**$22,587,000**
Land and Building Debt Service Cost	$1,410,000
Equipment Debt Service Cost	$652,000
Process Facility O&M[2]	$4,621,000
Third-Party Processing Cost	$2,657,000
Total Annual Cost	**$9,340,000**
Commodity Revenue[2]	($0)
Eliminate Third-Party Recyclables Processing Contract	($1,097,000)
Reduce Third-Party Drop-Off Locations Contract	($589,000)
Net Annual Processing Cost	**$7,654,000**
Net Processing Cost/Ton[4]	**$545**

Notes:

[1] Refer to Appendix B2 and B4 for breakdown of costs and assumptions.

[2] Includes ground transportation to the Kaua'i and O'ahu ports and shipping.

[3] Commodity revenue sharing between CCH and its third-party recycler is through adjustment of the processing fee based on fluctuations in commodity pricing (reviewed every six months). CCH reported the third-party processing rate fluctuated from $225 to $152 per ton over the past 12 months due to improved commodity prices. An average rate of $189 per ton is used in the O&M cost estimates.

[4] Assumes 14,055 tons of recyclables processed and 11,946 tons recovered, annually.

8 Conclusion

This evaluation assesses the considerations necessary for the County to either develop and operate a single-stream MRF or a facility to bale and ship recyclables for processing on the island of O'ahu. Assuming the facility begins operating in FY2029 (allowing four to five years to finance, design, permit, and construct), approximately 14,055 tons per year of recyclables are anticipated to require processing through the MRF, with 11,946 tons per year recovered as marketed commodities.

These estimated quantities include residential recyclables captured by a County-implemented curbside collection program and reduced number of recycling drop-off locations (HDR, 2025), residential and commercial recyclables currently recovered under the County's third-party contracted services, and additional commercial quantities currently landfilled that could be captured in a single-stream commercial collection program (refer to Sections 1.3 and 2).

Based on the estimated quantity of recyclables, this MRF evaluation considered a facility of approximate 40,000 sq ft. The building would include a tipping floor, processing equipment area, baling and interim storage area for commodities, and office with a break room and locker facilities. The MRF would be situated on approximately three acres in Līhuʻe to accommodate the building and ancillary infrastructure, such as weigh scales, roadways, storm water management, landscaping, and utilities.

Single-stream recycling equipment was selected to sort five primary commodities, including OCC, mixed paper, tin/steel and aluminum containers, mixed plastic containers, and glass. The equipment includes both standard and automated type equipment such as in-feed and presort conveyors, a glass crusher, fiber and container screening and sorting lines (including optical and ballistic separators), magnets and eddy current separators for metals and aluminum, balers, and other ancillary and rolling stock equipment. Given the annual quantity of recyclables to be processed and labor costs on the island of Kauaʻi, the potential use of higher-technology equipment (e.g., optical sorters and other robotic equipment) should be considered and evaluated during the design phase.

An alternative approach to developing and operating a single-stream MRF is to bale and ship the County's commingled recyclables to the island of Oʻahu for processing by the CCH's contracted third-party recycler (bale and ship option). ROM capital and O&M cost estimates for both developing a MRF and the bale and ship option indicate that the bale and ship option is the more cost-effective alternative (refer to Tables 4.4 and 7.1). Table 8.1 shows a comparison of processing costs for developing a MRF, implementing the bale and ship option, and continuing the current third-party-operated residential and commercial recycling program.

Table 8.1. Processing Cost Comparison (FY2029)

Category	MRF Development	Bale and Ship	Current Program
	Annual Cost or Revenue		
Total Capital Cost	**$57,223,000**	**$22,587,000**	**$0**
Land and Building Debt Service Cost	$2,790,000	$1,410,000	$0
Equipment Debt Service Cost	$2,911,000	$652,000	$0
Total Capital Debt Service	**$5,701,000**	**$2,062,000**	**$0**
O&M Cost	$7,189,000	$4,621,000	$0
Third-Party Processing Cost	$0	$2,657,000(1)	$2,274,000(2)
Total O&M and Debt Service Cost	**$12,890,000**	**$9,340,000**	**$2,274,000**

Table 8.1. Processing Cost Comparison (FY2029)			
	MRF Development	Bale and Ship	Current Program
Category	Annual Cost or Revenue		
Commodity Revenue	($1,006,000)	($0)	($0)
Eliminate Commercial Recyclables Processing Contract[2]	($1,097,000)	($1,097,000)	($0)
Reduced Drop-Off Locations Contract[3]	($589,000)	($589,000)	($0)
Net Processing Cost	**$10,198,000**	**$7,654,000**	**$2,274,000**
Recyclables Processed (tons)	**14,055[4]**	**14,055[4]**	**7,376[5]**
Net Cost/Ton	**$726**	**$545**	**$309**

Notes:

[1] Commodity revenue sharing between CCH and its third-party recycler is through adjustment of the processing fee based on fluctuations in commodity pricing (reviewed every six months). CCH reported the third-party processing rate fluctuated from $225 to $152 per ton over the past 12 months due to improved commodity prices. An average rate of $189 per ton is used in the O&M cost estimates.

[2] The current annual cost of the contracted third-party recycling program is $2,274,000. The total annual costs to manage the drop-off locations and commercial recyclables is $1,177,000 and $1,097,000, respectively.

[3] The cost to manage half of the drop-off locations is 50% of $1,177,000 ($589,000; rounded).

[4] Assumes 14,055 tons of recyclables are processed and 11,946 tons are recovered, annually.

[5] Estimated total residential and commercial recyclables that would be recovered in FY2029 based on the current recycling program (third-party contracted services).

In addition to cost considerations, processing recyclables on O'ahu would generate additional residual waste that would require disposal, either at CCH's WGSL or by shipping it back to the County for disposal at the Kekaha Landfill. However, similar to the Kekaha Landfill, WGSL has limited remaining capacity. As a result, the CCH may prefer to preserve that capacity for O'ahu's disposal needs and avoid potential public opposition to accepting off-island waste.

Other comparison factors between the two options include:

- The County would have full control over a County-operated MRF and would not be dependent on the performance and long-term stability of a third-party, off-island operator.
- A County-operated MRF could be expanded as needed to accommodate future increases in recyclable quantities, providing more flexibility for long-term planning and growth.
- The County would own the MRF after the 20-year investment period.
- The known annual O&M cost for a County-operated MRF are expected to remain relatively stable each year. In contrast, third-party processing, shipping, and

ground transportation costs could vary significantly due to fluctuations in commodity revenue, fuel prices, residual disposal costs, and contract terms.

- Depending on the need for additional permitting and/or environmental studies for the shipping component, the bale and ship option may have a shorter development timeline, as the third-party MRF is already operating.

The County has several contracting options for developing, operating, and maintaining a MRF as described in Section 5. Each option presents various levels of risk that must be carefully considered, including the types and quantities of materials received, the facility's operational performance and long-term maintenance requirements, and marketability of recovered commodities. A public-private partnership with a third-party operator and investor may offer the most cost-effective solution; however, the success of such an arrangement depends on a well-structured contract that clearly defines responsibilities, performance expectations, and operational requirements.

The estimated development timeline for the MRF ranges from 44 to 57 months. This timeframe is dependent on several factors, including land acquisition, the selected contracting approach, and the complexity of the permitting process (refer to Section 6).

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9 References

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Appendix A

A1 – Estimated Quantities of Commercial Recyclables Disposed of at the Kekaha Landfill

A2 – Estimated Quantities of Commercial Recyclables Recovered

A3 – Estimated Quantities of Processed and Recovered Recyclables (FY2029)

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Materials Recovery Facility Evaluation
Appendix A1 - Estimated Quantities of Commercial Recyclables Disposed at Kekaha Landfill

	Annual MSW Generation & Disposal (tons)			Estimated Quantity of Commercial Recyclables Disposed at Landfill[7] (tons)												
Fiscal Year[1,2]	Total MSW Generated	Total Residential MSW Disposed at RTS[4]	Commercial MSW Disposed[5]	Uncoated Corrugated Containers (4.3%)	Mixed Paper[6] (7.7%)	PET Containers - HI-5 (0.5%)	PET Containers - Non-HI-5 (0.3%)	HDPE Containers - HI-5 (0.1%)	HDPE Containers - Non-HI-5 (0.5%)	Plastic Containers #3 - #7 (1.2%)	Glass Bottles & Containers - HI-5 (0.9%)	Glass Bottles & Containers - Non-HI-5 (1.4%)	Tin/Steel Cans (0.4%)	Aluminum Cans - HI-5 (0.2%)	Aluminum Cans - Non-HI-5 (0.1%)	Total Recyclables[8,9]
2024[(3)]	89,535	35,465	38,908	1,673	2,996	195	117	39	195	467	350	545	156	78	39	5,486
2025	90,690	35,922	39,410	1,695	3,035	197	118	39	197	473	355	552	158	79	39	5,557
2026	91,860	36,386	39,919	1,716	3,074	200	120	40	200	479	359	559	160	80	40	5,629
2027	93,045	36,855	40,434	1,739	3,113	202	121	40	202	485	364	566	162	81	40	5,701
2028	94,245	37,331	40,955	1,761	3,154	205	123	41	205	491	369	573	164	82	41	5,775
2029	95,461	37,812	41,483	1,784	3,194	207	124	41	207	498	373	581	166	83	41	5,849
2030	96,692	38,300	42,019	1,807	3,235	210	126	42	210	504	378	588	168	84	42	5,925
2031	97,940	38,794	42,561	1,830	3,277	213	128	43	213	511	383	596	170	85	43	6,001
2032	99,203	39,295	43,110	1,854	3,319	216	129	43	216	517	388	604	172	86	43	6,078
2033	100,483	39,801	43,666	1,878	3,362	218	131	44	218	524	393	611	175	87	44	6,157
2034	101,779	40,315	44,229	1,902	3,406	221	133	44	221	531	398	619	177	88	44	6,236
2035	103,092	40,835	44,800	1,926	3,450	224	134	45	224	538	403	627	179	90	45	6,317
2036	104,422	41,362	45,378	1,951	3,494	227	136	45	227	545	408	635	182	91	45	6,398
2037	105,769	41,895	45,963	1,976	3,539	230	138	46	230	552	414	643	184	92	46	6,481
2038	107,133	42,436	46,556	2,002	3,585	233	140	47	233	559	419	652	186	93	47	6,564
2039	108,515	42,983	47,156	2,028	3,631	236	141	47	236	566	424	660	189	94	47	6,649
2040	109,915	43,538	47,765	2,054	3,678	239	143	48	239	573	430	669	191	96	48	6,735
2041	111,333	44,099	48,381	2,080	3,725	242	145	48	242	581	435	677	194	97	48	6,822
2042	112,769	44,668	49,005	2,107	3,773	245	147	49	245	588	441	686	196	98	49	6,910
2043	114,224	45,244	49,637	2,134	3,822	248	149	50	248	596	447	695	199	99	50	6,999
2044	115,698	45,828	50,277	2,162	3,871	251	151	50	251	603	452	704	201	101	50	7,089
2045	117,190	46,419	50,926	2,190	3,921	255	153	51	255	611	458	713	204	102	51	7,181
2046	118,702	47,018	51,583	2,218	3,972	258	155	52	258	619	464	722	206	103	52	7,273
2047	120,233	47,625	52,248	2,247	4,023	261	157	52	261	627	470	731	209	104	52	7,367
2048	121,784	48,239	52,922	2,276	4,075	265	159	53	265	635	476	741	212	106	53	7,462
2049	123,355	48,861	53,605	2,305	4,128	268	161	54	268	643	482	750	214	107	54	7,558

Notes

HI-5 - State of Hawaii Deposit Beverage Container Program

HDPE - High-Density Polyethylene Plastic (#2)

ISWMP - Integrated Solid Waste Management Plan

MSW - Municipal Solid Waste

PET - Polyethylene Terephthalate Plastic #1

RTS - Refuse Transfer Stations

[1] Fiscal Year (FY) 2024 (July 1, 2023 - June 30, 2024).

[2] The total MSW generation estimates for FY2029 through FY2049 are calculated using a 1.29% average annual waste increase in accordance with the County's 2021 ISWMP (Jacobs, 2021).

[3] The total MSW generated is from the County's FY2024 Annual Solid Waste Report.

[4] For the purposes of this report, RTS waste data are considered the total residential waste to be landfilled.

[5] FY2024 quantities exclude the non-MSW waste disposed according to the Kekaha Landfill FY2024 Annual Operating Report (Geosyntec, 2024).

[6] Includes kraft paper bags, newspaper, white ledger paper, and mixed paper shown in Table 8 of the 2016 Waste Characterization Study (Cascadia, 2017b).

[7] Estimated percentages of recyclables were pulled from Table 8 of the 2016 Waste Characterization Study (Cascadia, 2017b).

[8] Total quantity of recyclables does not include #3 through #7 plastic containers. These plastics are typically not included in present-day recycling programs due to lack of end markets.

[9] Excludes HI-5 and non-HI-5 glass in the commercial waste that is disposed of at the Kekaha Landfill. Only clean glass currently collected and processed at the County contracted third-party MRF.

Materials Recovery Facility Evaluation
Appendix A2 - Estimated Quantities of Commercial Recyclables Recovered

	Commercial Recyclables Recovered (tons)[3]								
Fiscal Year[1,2]	Total Recyclables Recovered	Corrugated Cardboard (65%)	Mixed Paper (2.6%)	HI-5 Plastic (6.1%)	Non-HI-5 Plastic (0.01%)	HI-5 Glass (15.3%)	Non-HI-5 Glass (8.0%)	Aluminum (3.1%)	Recyclables Processed[4] (tons)
2024[(3)]	4,196	2,724	108	256	0.40	640	337	131	4,938
2025	4,249	2,762	110	259	0.42	650	340	132	5,004
2026	4,303	2,797	112	262	0.43	658	344	133	5,068
2027	4,359	2,833	113	266	0.44	667	349	135	5,133
2028	4,415	2,870	115	269	0.44	675	353	137	5,200
2029	4,472	2,907	116	273	0.45	684	358	139	5,267
2030	4,529	2,944	118	276	0.45	693	362	140	5,335
2031	4,588	2,982	119	280	0.46	702	367	142	5,403
2032	4,647	3,021	121	283	0.46	711	372	144	5,473
2033	4,707	3,060	122	287	0.47	720	377	146	5,544
2034	4,768	3,099	124	291	0.48	729	381	148	5,615
2035	4,829	3,139	126	295	0.48	739	386	150	5,688
2036	4,891	3,179	127	298	0.49	748	391	152	5,761
2037	4,955	3,220	129	302	0.50	758	396	154	5,835
2038	5,018	3,262	130	306	0.50	768	401	156	5,911
2039	5,083	3,304	132	310	0.51	778	407	158	5,987
2040	5,149	3,347	134	314	0.51	788	412	160	6,064
2041	5,215	3,390	136	318	0.52	798	417	162	6,142
2042	5,282	3,434	137	322	0.53	808	423	164	6,221
2043	5,351	3,478	139	326	0.54	819	428	166	6,302
2044	5,420	3,523	141	331	0.54	829	434	168	6,383
2045	5,490	3,568	143	335	0.55	840	439	170	6,465
2046	5,560	3,614	145	339	0.56	851	445	172	6,549
2047	5,632	3,661	146	344	0.56	862	451	175	6,633
2048	5,705	3,708	148	348	0.57	873	456	177	6,719
2049	5,778	3,756	150	352	0.58	884	462	179	6,806

Notes

HI-5 - State of Hawaii Deposit Beverage Container Program

GID - Garden Isle Disposal, Inc.

ISWMP - Integrated Solid Waste Management Plan

[1] Fiscal Year (FY) 2024 (July 1, 2023 - June 30, 2024).

[2] For FY2029 through FY2049, quantities were projected using a 1.29% average annual waste increase in accordance with the County's 2021 ISWMP (Jacobs, 2021).

[3] Estimated percentages of recyclables were calculated using the quantities provided in the County's FY2024 Annual Solid Waste Report to the Mayor for Contract No. 212818. Includes recyclable quantities collected through the County Office Recycling Program.

[4] An assumed 15% contamination rate is applied to the reported quantities to estimate the amount of material processed by the third-party contractor.

Materials Recovery Facility Evaluation
Appendix A3 - Estimated Quantities of Processed and Recovered Recyclables (FY2029)

Material Type	Residential Recycling Curbside Collection Program (tons)[1,2]	Drop-Off Locations (tons)[3,4]	Commercial Recyclables Processed by GID (tons)[5]	Commercial Single-Stream Recycling Program (tons)[1,2]	Total (tons)
Corrugated Containers	1,572	574	3,420	1,070	
Mixed Paper	2,002	278	137	1,916	
PET Containers - HI-5	91		160	124	
PET Containers - Non-HI-5	79	11	0.3	74	
HDPE Containers - HI-5	46		160	25	
HDPE Containers - Non-HI-5	147	11	0.3	124	
Glass Bottles and Containers - HI-5			805		
Glass Bottles and Containers - Non-HI-5		142	421		
Tin/Steel Cans	197	38		100	
Aluminum Cans - HI-5	68			50	
Aluminum Cans - Non-HI-5	23	0.1	164	25	
Total Processed Recyclables[6]	**4,225**	**1,054**	**5,268**	**3,508**	**14,055**
Total Recovered Recyclables[7]	**3,591**	**896**	**4,477**	**2,982**	**11,946**

Notes

[1] Quantities are based on FY2024 residential and commercial quantities reported by the County and estimated percentages of recyclable materials provided in the 2016 Characterization Study (Cascadia 2017b). Residential single-stream curbside collection program quantities include half of the drop-off locations that would be closed. Quantities are inflated 1.29% per year to estimate FY2029 quantities.

[2] Quantities include an applied 60% capture rate (industry standard) of recyclables currently disposed at the Kekaha Landfill that will be recovered for recycling.

[3] Plastic is assumed to be 50% PET and 50% HDPE with no HI-5 plastic containers.

[4] Estimated quantities collected at half of the drop-off locations that remain open.

[5] Total recovered quantity includes those reported in the County's FY2024 Annual Solid Waste Report to the Mayor for Contract No. 212818 and the County Office Recycling Program. Quantities are inflated 1.29% per year to estimate FY2029 quantities. An assumed contamination rate of 15% is applied to the reported quantities to estimate the amount of material processed by the third-party contractor.

[6] Excludes HI-5 and non-HI-5 glass in the residential and commercial waste that is disposed of at the Kekaha Landfill. Only clean glass currently collected by the third-party contractor is assumed to be processed at the MRF (i.e., the single-stream recycling curbside collection program excludes glass). #3-#7 plastics have also been excluded from this MRF evaluation.

[7] An assumed contamination rate of 15% is applied to the total processed quantities to determine the total recyclables recovered.

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Appendix B

B1 - ROM Capital Cost Estimate (FY2029)

B2 - ROM Capital Cost Estimate, Shipping and Processing on O'ahu (FY2029)

B3 - ROM Annual Operation & Maintenance Cost Estimate (FY2029)

B4 - ROM Annual Operation & Maintenance Cost Estimate, Shipping and Processing on O'ahu (FY2029)

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Materials Recovery Facility Evaluation
Appendix B1 - ROM Capital Cost Estimate (FY2029)

Project:	County of Kauai, MRF Evaluation
Estimator:	Mike Kaiser, HDR
Reviewer:	Tim Steinberger, HDR
Date:	Apr-25
Estimate Basis:	Rough Order of Magnitude
Costs:	2024$ Inflated to 2029$

1.	LAND ACQUISITION		$4,950,000
2.	SITE CIVIL WORK		$4,097,000
3.	BUILDING & OTHER STRUCTURAL		$11,908,000
4.	PROCESSING AND ROLLING EQUIPMENT		$13,547,000
	SUBTOTAL ITEMS 1 - 4		$34,502,000
	ITEMS 1-4 INFLATED TO FY2029 (3%/YEAR)	16%	$5,521,000
	ENGINEERING & PERMITTING	6%	$2,401,000
	CONSTRUCTION ADMINISTRATION	4%	$1,601,000
	CONTINGENCY	30%	$13,208,000
	SUBTOTAL		$57,233,000
	GET (Assumed Included in Unit Costs)		$0
	TOTAL CAPITAL COST (ROUNDED)		**$57,233,000**

1. LAND ACQUISITION

Item	Quantity	Units	Unit Price	Item Cost	Total
Site Acquisition					$4,950,000
Acquisition of 3 acres of agricultural- or industrial-zoned land	3	AC	$1,500,000	$4,500,000	
Fees (10%)	1	LS	$450,000	$450,000	
Subtotal Item 1					$4,950,000

2. SITE CIVIL WORK

Item	Quantity	Units	Unit Price	Item Cost	Total
Demolition & Clear/Grub					$175,000
Demolition of existing	1	LS	$100,000	$100,000	
Clear and grub site (vegetation)	3	AC	$25,000	$75,000	
Erosion and Sediment Controls (BMPs)					$150,000
BMPs	1	LS	$150,000	$150,000	
Site Earthwork					$835,000
General earthwork excavation and embankment (12" average across site)	4,840	CY	$150	$726,000	
Site grading	14,520	SY	$8	$108,900	
Asphalt Roadways					$1,325,000
2" Asphalt concrete pavement	790	TN	$350	$277,000	
6" Asphalt concrete base course	2,370	TN	$300	$711,000	
6" Aggregate base	1,210	CY	$90	$108,900	
12" Select aggregate subbase	2,420	CY	$90	$217,800	
ADA parking signage, wheel stops, and striping	1	LS	$5,000	$5,000	
Parking stalls for employees and miscellaneous striping	1	LS	$4,500	$4,500	
Site Stormwater Management					$350,000
Stormwater system (piping. manholes, outfall structures, swales, etc.)	1	LS	$350,000	$350,000	

Potable Water, Sewer, Fire Protection, & Electric Utilities to MRF Building					$444,000
Potable water and fire protection utilities to MRF building	1	LS	$175,000	$175,000	
Traffic rated septic system or lateral connection at street	1	LS	$150,000	$150,000	
Electric service connection at street or overhead to building	1	LS	$70,000	$70,000	
Site lighting	1	LS	$48,500	$48,500	
Site communications	1	LS	$15,500	$15,500	
Miscellaneous					$445,000
Signage	1	LS	$3,500	$3,500	
Entrance gates	1	LS	$25,000	$25,000	
Chain link fencing	1,440	LF	$150	$216,000	
Landscaping	1	LS	$75,000	$75,000	
Other exterior improvements	1	LS	$50,000	$50,000	
Material testing	1	LS	$75,000	$75,000	
Mob/demob, contractor overhead, liability insurance & other general conditions					$373,000
Percent of Total Cost	10	%	$3,724,000	$372,400	
Subtotal Item 2					$4,097,000

Notes:

Asphalt area is 1.5 acre, building and weigh scale is 1 acre, landscaping and stormwater system is 0.5 acre.

Potable water assumed at street.

3. BUILDING & OTHER STRUCTURAL

Item	Quantity	Units	Unit Price	Item Cost	Total
MRF Building (40,000 SQ FT)					$10,825,000
8" thick slab on grade	40,000	SQ FT	$50	$2,000,000	
Column foundations at exterior (50 total)	150	CY	$3,500	$525,000	
Equipment foundations	50	CY	$3,500	$175,000	
PEMB with HVAC, fire suppression system, lighting, doors and other	40,000	SQ FT	$145	$5,800,000	
Interior office, break room and locker buildout	1,000	SQ FT	$750	$750,000	
Approach slab at tipping floor (10,000 SQ FT)	10,000	SQ FT	$40	$400,000	
Push wall at tipping floor	125	CY	$4,500	$562,500	
Loading dock	75	CY	$3,500	$262,500	
Miscellaneous other concrete walkways, bollards, etc.	1	LS	$100,000	$100,000	
Weigh scale	1	LS	$250,000	$250,000	
Mob/demob, contractor overhead, liability insurance & other general conditions					$1,083,000
Percent of Total Cost	10	%	$10,825,000	$1,082,500	
Subtotal Item 3					$11,908,000

4. PROCESSING AND ROLLING EQUIPMENT

Item	Quantity	Units	Unit Price	Item Cost	Total
Processing Equipment					$8,205,000
Infeed System and Presort Line					
Metering bin/hopper and drum	1	LS	$500,000	$500,000	
Infeed conveyor and auger screens	1	LS	$250,000	$250,000	
Presort conveyor and sort platform	1	LS	$425,000	$425,000	
Glass Crushing Line					
Infeed Bin, Conveyor, and Glass Crusher	1	LS	$300,000	$300,000	
Fiber Sort Line					
OCC screen, optical, and ballistic seperators	1	LS	$1,080,000	$1,080,000	
OCC sort station platform and conveyor	1	LS	$800,000	$800,000	
Container Sort Line					
Container optical sorter with blowers	1	LS	$1,100,000	$1,100,000	
Eddy current/magnets	1	LS	$50,000	$50,000	
OCC sort station platform and conveyor	1	LS	$1,300,000	$1,300,000	
Storage and Baling					
Push-thru fiber bunkers and container bottom bunkers	1	LS	$1,100,000	$1,100,000	
Baler feed conveyor	2	LS	$150,000	$300,000	
Baler	2	LS	$500,000	$1,000,000	
Processing Equipment Shipping					$1,000,000
Shipping allowance	1	LS	$1,000,000	$1,000,000	
Processing Equipment Installation					$3,282,000
Installation, start-up, and parts (40% of cost)	1	LS	$8,205,000	$3,282,000	

Rolling Equipment					$1,060,000
Mid sized loader	1	LS	$300,000	$300,000	
Skid steer loader	1	LS	$75,000	$75,000	
Fork lift	1	LS	$75,000	$75,000	
30-cy rolloff containers for glass storage and residuals	6	EA	$20,000	$120,000	
Shipping containers and chassis	12	EA	$20,000	$240,000	
Terminal tractor	1	EA	$100,000	$100,000	
Site trucks (Supervisor & Other)	2	EA	$75,000	$150,000	
Subtotal Item 4					$13,547,000
Subtotal Items 1 - 4					$34,502,000

Notes:

1. Assumed three-acre site and the site is located on agricultural- or industrial-zoned land.
2. Assumes a 40,000-sq ft pre-engineered metal building with interior buildout (e.g., heating, ventilation, and air conditioning, fire suppression system, lighting).
3. Assumes 1,000 sq ft with lockers, breakroom, and offices for supervisor and scale operator.
4. Includes standard processing equipment as shown in Figures 1 and 2.

Abbreviations

AC - Acre/Asphalt Concrete
ADA - Americans with Disabilities Act
BMPs - Best Management Practices
CY - Cubic Yard(s)
EA - Each
GET - General Excise Tax
HVAC - Heating, Ventilation, and Air Conditioning
LF - Linear Feet
LS - Lump Sum
Mob/Demob - Mobilization/Demobilization
MRF - Materials Recovery Facility
OCC - Old Corrugated Cardboard
PEMB - Pre-Engineered Metal Building
PET - Polyethylene terephthalate Plastic (#1)
ROM - Rough Order of Magnitude
SQ FT - Square Feet
SY - Square Yard(s)
TPH - Tons Per Hour
% - Percent/Percentage

Materials Recovery Facility Evaluation
Appendix B2 - ROM Capital Cost Estimate
Shipping and Processing on O‘ahu (FY2029)

Project:	County of Kauai, MRF Evaluation
Estimator:	Mike Kaiser, HDR
Reviewer:	Tim Steinberger, HDR
Date:	Mar-25
Estimate Basis:	Rough Order of Magnitude
Costs:	2026 $ Inflated to FY2029

1.	SITE ACQUISITION		$1,650,000
2.	CIVIL SITE WORK		$1,687,000
3.	BUILDING & OTHER STRUCTURAL		$7,248,000
4.	PROCESSING AND ROLLING EQUIPMENT		$3,030,000
	SUBTOTAL ITEMS 1 - 4		$13,615,000
	ITEMS 1-4 INFLATED TO FY2029 (3%/YEAR)	16%	$2,179,000
	ENGINEERING & PERMITTING	6%	$948,000
	CONSTRUCTION ADMINISTRATION	4%	$632,000
	CONTINGENCY	30%	$5,213,000
	SUBTOTAL		$22,587,000
	GET (ASSUMED INCLUSIVE IN COSTS)		$0
	TOTAL CAPITAL COST (ROUNDED)		**$22,587,000**

1. SITE ACQUISITION

Item	Quantity	Units	Unit Price	Item Cost	Total
Site Acquisition					$1,650,000
Acquisition of 1 acre of agricultural- or industrial-zoned land	1	AC	$1,500,000	$1,500,000	
Fees (10%)	1	LS	$150,000	$150,000	
Subtotal Item 1					$1,650,000

2. SITE CIVIL WORK

Item	Quantity	Units	Unit Price	Item Cost	Total
Demolition & Clear/Grub					$60,000
Demolition of existing	1	LS	$35,000	$35,000	
Clear and grub site (vegetation)	1	AC	$25,000	$25,000	
Erosion and Sediment Controls (BMPs)					$50,000
BMPs	1	LS	$50,000	$50,000	
Site Earthwork					$278,300
General earthwork excavation and embankment (12" average)	1,613	CY	$150	$242,000	
Site grading	4,840	SY	$8	$36,300	
Asphalt Roadway					$411,900
2" Asphalt concrete pavement	242	TN	$350	$84,700	
6" Asphalt concrete base course	726	TN	$300	$217,800	
6" Aggregate base	370	CY	$90	$33,300	
12" Select aggregate subbase	740	CY	$90	$66,600	
ADA parking signage, wheel stops, and striping	1	LS	$5,000	$5,000	
Parking stalls for employees and miscellaneous striping	1	LS	$4,500	$4,500	
Site Stormwater Management					$200,000
Stormwater system (piping. manholes, outfall structures, swales, etc.)	1	LS	$200,000	$200,000	

Potable Water, Sewer, Fire Protection, & Electric Utilities to Transfer Building					$295,000
Potable water and fire protection utilities to transfer building	1	LS	$175,000	$175,000	
Traffic rated septic system or lateral connection at street	1	LS	$50,000	$50,000	
Electric service connection at street or overhead to building	1	LS	$70,000	$70,000	
Site lighting	1	LS	$48,500	$48,500	
Site communications	1	LS	$15,500	$15,500	
Miscellaneous					$238,000
Signage	1	LS	$3,500	$3,500	
Entrance gates	1	LS	$25,000	$25,000	
Chain link fencing	830	LF	$150	$124,500	
Landscaping	1	LS	$25,000	$25,000	
Other exterior improvements	1	LS	$25,000	$25,000	
Material testing	1	LS	$35,000	$35,000	
Mob/demob, contractor overhead, liability insurance & other general conditior					$153,400
Percent of Total Cost	10	%	$1,533,200	$153,400	
Subtotal Item 2					$1,687,000

3. BUILDING & OTHER STRUCTURAL

Item	Quantity	Units	Unit Price	Item Cost	Total
Transfer/Processing Building (18,500 SQ FT)					$6,588,500
8" thick slab on grade	18,500	SQ FT	$50	$925,000	
Equipment foundations	25	CY	$5,000	$125,000	
Column foundations at exterior (30 total)	100	CY	$3,500	$350,000	
PEMB with HVAC, fire suppression system, lighting, doors and other	18,500	SQ FT	$175	$3,238,000	
Interior office, break room and locker buildout	500	SQ FT	$750	$375,000	
Approach slab at tipping floor (100' X 100')	10,000	SQ FT	$40	$400,000	
Push wall at tipping floor	125	LS	$4,500	$563,000	
Loading dock	75	CY	$3,500	$262,500	
Miscellaneous other concrete walkways, bollards, etc.	1	LS	$100,000	$100,000	
Weigh scale (one to service inbound/outbound)	1	LS	$250,000	$250,000	
Mob/demob, contractor overhead, liability insurance & other general conditior					$658,900
Percent of Total Cost	10	%	$6,588,500	$658,900	
Subtotal Item 3					$7,248,000

4. PROCESSING AND ROLLING EQUIPMENT

Item	Quantity	Units	Unit Price	Item Cost	Total
Processing Equipment					$1,500,000
Baler	2	LS	$500,000	$1,000,000	
Baler feed conveyor/hopper	2	LS	$100,000	$200,000	
Infeed Bin, Conveyor, and Glass Crusher	1	LS	$300,000	$300,000	
Processing Equipment Shipping					$100,000
Shipping allowance	1	LS	$100,000	$100,000	
Processing Equipment Installation					$600,000
Installation, start-up, and parts (40% of cost)	1	LS	$1,500,000	$600,000	
Rolling Equipment					$830,000
Mid sized loader	1	LS	$300,000	$300,000	
Fork lift	1	LS	$75,000	$75,000	
Shipping containers and chassis	14	EA	$20,000	$280,000	
Terminal tractor	1	EA	$100,000	$100,000	
Superintendent truck	1	LS	$75,000	$75,000	
Subtotal Item 4					$3,030,000
Subtotal Items 1 - 4					$13,615,000

Notes:

1. Assumed one-acre site and the site is located on agricultural- or industrial-zoned land.
2. Assumes a 18,500-sq ft pre-engineered metal building with interior buildout (e.g., heating, ventilation, and air conditioning, fire suppression system, lighting).
3. Assumes 1,000 sq ft with lockers, breakroom, and offices for supervisor and scale operator.

CY - Cubic Yard(s)
EA - Each
GET - General Excise Tax
HVAC - Heating, Ventilation, and Air Conditioning
LF - Linear Feet
LS - Lump Sum
Mob/Demob - Mobilization/Demobilization
MRF - Materials Recovery Facility
OCC - Old Corrugated Cardboard
PEMB - Pre-Engineered Metal Building
PET - Polyethylene terephthalate Plastic (#1)
ROM - Rough Order of Magnitude
SQ FT - Square Feet
SY - Square Yard(s)
TPH - Tons Per Hour
% - Percent/Percentage

Materials Recovery Facility Evaluation
Appendix B3 - ROM Annual Operation & Maintenance Cost Estimate (FY2029)

Category	Quantity	Unit	Unit Cost	Cost[1]
Facility Manager/Operations Supervisor	1	Staff[2]	$148,364	$149,000
Mechanics for Facility & Equipment Maintenance	1	Staff	$198,360	$199,000
Equipment Operators	2	Staff	$133,864	$268,000
Scale Operator & Clerical	2	Staff	$104,052	$209,000
Sorters[2]	8	Agency	$70,992	$568,000
Overtime		% of Labor[2]	20%	$136,000
Miscellaneous Uniforms & Safety per Union Agreement	1	LS	$38,280	$39,000
Total Labor Cost (FTE)	**14**			**$1,568,000**
Fuel[3]	24,480	Gallon	$8.00	$196,000
Building and Equipment Maintenance		% of Capital	1%	$573,000
Consumables (Lubricants, Baler Wire, etc.)	14,055	$/Ton[4]	$3.00	$43,000
Utilities	14,055	$/Ton[4]	$10.00	$141,000
Miscellaneous (Insurance, Permits, etc.)		% of Capital	0.50%	$287,000
Commodity Shipping and Ground Transportation[5]	11,946	Tons	$337	$4,026,000
Residuals Transportation and Disposal[6]	2,109	Tons	$168	$355,000
Total Annual O&M Cost (FY2029)[7]				**$7,189,000**

Notes

FTE – Full-Time Equivalent

O&M - Operation & Maintenance

ROM - Rough Order of Magnitude

% - percent/percentage

[1] Costs are rounded and based on 255 operating days per year, 8 hours per day.

[2] Staff positions are based on 2,080 hours per year. Sorter positions are based on 2,040 hours per year. Overtime is assumed at 20% of annual labor costs for Mechanics, Equipment Operators, and Scale Operator & Clerical positions.

[3] Assumed average 2 gallons per hour for each piece of rolling equipment.

[4] Cost per ton of recyclables processed (14,055 tons).

[5] Assumed 3rd party trucking cost of $150 per hour. Four and one-half hour round trip time at mainland and Kauai ports combined and 22 tons of commodities per load. Includes Matson quote for shipping ($306/ton) and transportation at ports ($31/ton). Refer to Appendix C1 for assumptions.

[6] Transportation ($30 per ton) and disposal at Kekaha Landfill ($119 per ton current inflated to $138 per ton [FY2029]).

[7] FY2024 costs inflated 3% per year to FY2029.

Materials Recovery Facility Evaluation
Appendix B4 - ROM Annual Operation & Maintenance Cost Estimate
Shipping and Processing on O‘ahu (FY2029)

Category	Quantity	Unit	Unit Cost	Cost[1]
Facility Manager/Operations Supervisor	1	Staff[2]	$148,364	$149,000
Equipment Operators	3	Staff	$133,864	$402,000
Laborer	2	Staff	$104,052	$209,000
Scale Operator & Clerical	1	Staff	$104,052	$105,000
Overtime		% of Labor[2]	20%	$144,000
Miscellaneous Uniforms & Safety per Union Agreement	1	LS	$20,000	$20,000
Total Labor Costs (FTE)	**7**			**$1,029,000**
Fuel[3]	16,320	Gallon	$8.00	$131,000
Building and Equipment Maintenance		% of Capital	1%	$226,000
Utilities	14,055	$/Ton[4]	$5.00	$71,000
Consumables (Lubricants, Baler Wire, etc.)	14,055	$/Ton[4]	$2.00	$29,000
Miscellaneous (Insurance, Permits, etc.)		% of Capital	0.50%	$113,000
Transportation of Commodities to and from ports on Kauau and Oahu[5]	2,875	Hours	$150	$432,000
Shipping[6]	639	Containers/Year	$3,652	$2,334,000
Third Party Processing[7]	14,055	Tons	$189	$2,657,000
Residuals Transportation and Disposal[8]	2,108	Tons	$121	$256,000
			Total Annual O&M Cost (FY2029)	**$7,278,000**

Notes

FTE – Full-Time Equivalent

O&M - Operation & Maintenance

ROM - Rough Order of Magnitude

[1] Costs are based on 255 operating days per year, 8 hours per day. Rounded up to $1,000.

[2] Staff positions are based on 2,080 hours per year. Overtime is assumed at 20% of annual labor costs for equipment operators, and scale operator and clerical positions.

[3] Assumed average 2 gallons per hour for each piece of rolling equipment.

[4] Cost per ton of recyclables processed (14,055 tons; 12,687 of commingled and 1,368 tons of glass]).

[5] Assumed trucking cost of $150 per hour. Four and one-half hours round trip time to ports on Oahu and Kauai combined and 22 tons of baled or loose (glass) material per container. Approximately 12 containers loaded and shipped per week (639 per year).

[6] Young Brothers quote $2,400 port to port (inflated 3%/ year to FY2029). Assume $750 return empty and port holding fee (if needed).

[7] Average 3rd party processing cost for CCH (past 12 months).

[8] Transportation ($5 per ton) and disposal at H-POWER ($100 per ton FY2024 inflated to $116 per ton FY2029).

Appendix C

C1 – Mainland Commodity Revenue (FY2029)

C2 – Estimated Shipping and Ground Transportation to Mainland (FY2029)

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Materials Recovery Facility Evaluation
Appendix C1 - Mainland Commodity Revenue (FY2029)

Material Type[5]	Residential Single-Stream Curbside Collection Program Quantities (tons)[1]	Drop-Off Locations (tons)[1]	Commercial Recyclables Recovered by GID (tons)[2]	Commercial Single-Stream Recycling Program (tons)	Combined Recovered Quantities (tons)	Commodity Price (5-year Average)[5]	FY2026 Total Value (Rounded)
Corrugated Containers	1,336	487	2,907	910	5,640	$ 64.00	$ 361,000
Mixed Paper	1,702	236	116	1,629	3,683	$ 36.20	$ 133,400
PET Containers - HI-5	77		136	105	319	$ 256.72	$ 81,900
PET Containers - Non-HI-5	67	9	0	63	140	$ 256.72	$ 35,900
HDPE Containers - HI-5	39		136	21	196	$ 58.00	$ 11,400
HDPE Containers - Non-HI-5	125	9		105	240	$ 58.00	$ 14,000
Glass Bottles and Containers - H-5			684		684	$ (38.50)	$ (26,400)
Glass Bottles and Containers - Non-H-5		121	358		479	$ (38.50)	$ (18,500)
Tin/Steel Cans	167	32		85	284	$ 166.50	$ 47,400
Aluminum Cans - HI-5	58			43	100	$ 1,304.00	$ 130,800
Aluminum Cans - Non-HI-5	20	0	139	21	180	$ 1,304.00	$ 235,000
Total Recyclables	**3,591**	**896**	**4,476**	**2,982**	**11,946**		
						Total Commodity Value	$ 1,005,900
						Shipping Cost/Ton and Total[3]	$ 306 $ (3,657,700)
						Ground Transportation Cost/Ton and Total[4]	$ 31 $ (366,600)
						Net Total Revenue	$ (3,018,400)

Notes

[1] Quantities are based on FY2024 residential and commercial quantities reported by the County and estimated percentages of recyclable materials provided in the 2016 Characterization Study (Cascadia 2017b). Residential single-stream curbside collection program quantities include half of the drop-off locations that would be closed. Quantities are inflated 1.29% per year to estimate FY2029 quantities. An assumed 60% capture rate and 15% contamination rate are applied (refer to Appendix A3).

[2] Total recovered quantity includes those reported in the County's FY2024 Annual Solid Waste Report to the Mayor for Contract No. 212818 and the County Office Recycling Program. Quantities were inflated 1.29% per year to estimate FY2029 quantities. An assumed contamination rate of 15% was applied to the reported quantities to estimate the amount of material processed by GID.

[3] Shipping cost includes inflated Matson quote ($6,736/container [FY2029]).

[4] Ground transportation assumes 3 hours travel in California and 1.5 hours on Kauai at $150/hour.

[5] #3-#7 plastics has been excluded from this MRF evaluation.

Materials Recovery Facility Evaluation
Appendix C2 - Estimated Shipping and Ground Transportation to Mainland (FY2029)

Material Type	Combined Recovered Quantities (tons)
Corrugated Containers	5,640
Mixed Paper	3,683
PET Containers - HI-5	319
PET Containers - Non-HI-5	140
HDPE Containers - HI-5	196
HDPE Containers - Non-HI-5	240
Glass Bottles and Containers - H-5	684
Glass Bottles and Containers - Non-H-5	479
Tin/Steel Cans	284
Aluminum Cans - HI-5	100
Aluminum Cans - Non-HI-5	180
Total Recyclables	11,946
Total Containers Shipped	543

Per Ton and Total Shipping Cost	**$306**	**$ 3,657,603**
Per Ton and Ground Transportation	**$31**	**$ 366,521**
Combined Cost per Ton		**$ 337**

Item	Assumption	Notes
Shipping Cost Quote (Nawiliwili - Long Beach Piers)	$ 6,736	Quote Matson ($5,811/container) inflated 3% per year to FY2029.
Transport To and From Piers (per ton)	$ 675	Assumed $150/hour California/Kauai trucking rate (3 hours CA and 1.5 hours Kauai).
Maximum Weight in Shipping Container (tons)	22	Maximum weight per US Interstate (80,000 lbs gross). Gross less tractor, chassis, and container tare weight is approx. 22 tons.