Sustainable Waste Management for Hawaii's Correctional Facilities: Barriers to Implementation

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EXECUTIVE SUMMARY

As correctional facilities seek to address overcrowding, increased expenses, and a 50% national recidivism rate, many facilities are looking towards creative measures in sustainability programs such as waste management (Benecchi, 2021). In order to implement successful waste management programs, the barriers to implementation must first be addressed. These barriers were discovered through a waste audit conducted on 8 of Hawaii's correctional facilities due to the lack of national correctional facility data on waste composition and operations. The correctional facilities under this study include: Hawaii Community Correctional Center (HCCC), Kulani Correctional Facility (KCF), Kauai Community Correctional Center (KCCC), Maui Community Correctional Center (MCCC), Oahu Community Correctional Center (OCCC), Halawa Correctional Facility (HCF), Waiawa Correctional Facility (WCF), and Women's Community Correctional Center (WCCC).

The completion of the waste audit provided data for the overall waste operations, waste composition make-up for each site, potential areas to implement waste management programs and barriers to implementation of the waste management programs. Through the study and waste audit, the following barriers to implementation of a more sustainable waste management program were found: the need to determine site specific waste composition make-up to act as a benchmark or standard for each site, cost of equipment or budget constraints, understaffing of adult correctional officers (ACO), and ease of implementation.

The data gathered from the waste audit, environmental assessment previously completed for each site, as well as research on successful programs with waste management programs implemented provided methods to potentially eliminate or mitigate the barriers to implementation. These include leadership support, policy changes, scorecard matric, training and education, and cost savings and revenue. The greatest limitation to this study is the COVID-19 Pandemic that caused an increase in certain wastes produced as well as an inaccurate depiction of inmate populations as many inmates were released prematurely to deal with the overcrowding and rapid spread of the disease.

Keywords: recycling, correctional facility, prisons, institutions, plastic, paper, metal, food, compost, sustainability, waste management

TABLE OF CONTENTS

EXECUTIVE SUMMARY 2
1.0 INTRODUCTION 4
2.0 METHODS 5
2.1 Waste Audit Procedure 5
2.1.1 Barriers to Implementation Procedure 5
2.2 Site-Specific Waste Composition Make-up Procedure 6
3.0 RESULTS 8
4.0 DISCUSSION 14
4.1 Leadership Support 14
4.2 Policy Changes 15
4.3 Scorecard Matrix Tool 15
4.4 Training and Education 15
4.5 Cost Savings and Revenue 16
5.0 CONCLUSION & RECOMMENDATIONS 16
5.1 Conclusion 16
5.2 Recommendations 17
6.0 REFERENCES 19
7.0 APPENDIX 22

LIST OF TABLES

Table 1. Site Specific Waste Composition Make-up 10
Table 2. Estimated Average of Total Waste Produced per Inmate per Day at each Facility 12
Table 3. Estimated Ranges of Percent Breakdown for Solid Waste Composition at each Facility 13
Table 4. Barriers to Implementation 14

LIST OF APPENDICES

Appendix 1. Interview Questions 22
Appendix 2. Volume-to-Weight Conversion Factors 22
Appendix 3. Scorecard Matrix Tool 24

1.0 INTRODUCTION

Many correctional facilities face ongoing issues of overcrowding, increased expenses, and a national average of more than 50% recidivism rate, with these issues, correctional facility officials are seeking solutions in sustainability programs (Benecchi, 2021). In 2017, neighbor island prisons held the highest percentage of housing inmates over the design capacity with Hilo at 50% over capacity, Maui at 60% over capacity, Kauai at 48% over capacity and Oahu coming in at 25% over capacity (Lincoln, 2018). In 2019, Act 179 Part 1 established the Hawaii Correctional System Oversight Commission. The members of this commission work towards "establishing maximum inmate population limits for each correctional facility and formulate policies and procedures to prevent the inmate population from exceeding the capacity of each correctional facility" (Patterson, 2020). Most recently at the start of the COVID-19 pandemic, a supreme court proceeding presented that Hawaii's Correctional Facilities were overcrowded and unsafe. Despite many efforts to manage the overcrowding issues at Hawaii's correctional facilities, officials are still seeking solutions to solve this issue. In a report released in June 2020 by the Hawaii Department of Health, it recorded that Hawaii's correctional facilities had a recidivism rate for those on probation at 64.7%. For inmates that served their maximum term, the recidivism rate was 49.3% (Wong, 2020). The average time elapsed before offenders recidivate is 10.1 months with approximately half of the offenders recidivating within one year from the date of release. Since the state spends around $140 per inmate per day for program services, food, health care, and administrative costs which amounts to roughly $51,100 to keep a single inmate incarcerated for one year (KHON2, 2016). It is critical for officials to move towards sustainable solutions that will limit waste, provide revenue or savings, and prepare inmates with experience that can help them join the job force upon their release.

In 2018, the Environmental Protection Agency (EPA) reported a nationwide total of 292.4 million tons of municipal waste produced which averages out to 4.9 lbs. per person per day ("National Overview: Facts and Figures on Materials, Wastes and Recycling, 2021). Based on a waste composition study conducted by Kessler Consulting for correctional facilities in Florida, an inmate produced around 4 pounds per day. Environmental Assessments completed by Louis Berger Group, Inc. on Hawaii correctional facilities in 2008 and 2018-2020 suggests that male inmates produce 2 pounds of waste per inmate per day while women produce 4 pounds of waste per inmate per day. Unfortunately, no nationwide data specific to correctional facilities can be found on average composition of waste, or the average waste generated per inmate per day. Paper, plastic, and organic matter makeup most of the waste in correctional facilities. Therefore, they should be the primary target when first implementing a waste management plan. Florida's correctional facility's composition study reported that paper accounted for 38%, plastic 9%, and organic matter 35% of total waste. Organic matter consists of food waste and green waste. In a similar study, New York Department of Correctional Services reported paper waste makes up 40%, plastics 15%, and organic matter 37% in New York correctional facilities (Kessler Consulting Inc, 2004). The EPA indicated that the U.S. waste composition for 2018 had paper waste at 23.05%, plastic at 12.2%, and organic waste accounted for 39.89% ("National Overview: Facts and Figures on Materials, Wastes and Recycling, 2021). Similarly, a 2017 study on the state of Hawaii's waste composition, paper accounted for 22.7%, plastic was 9.8%, and organic matter accounted for 35.5% of the waste make-up (2017 Waste Composition Study, 2018). The variances in waste composition breakdown between the Florida correctional facilities, New York correctional facilities, EPA nationwide averages, and the state of Hawaii, demonstrates the need to conduct a waste audit on the Hawaii correctional facilities to gain a

more accurate understanding of the total waste produced for each waste type to have a successful waste management plan.

To devise a more sustainable waste management program and determine barriers to implementation at Hawaii's 8 correctional facilities, a waste audit was conducted including gathering data from field visits completed through February 2021 through August 2021, interviews with staff, and Environmental Assessments completed by Louis Berger Group, Inc. The following correctional facilities In Hawaii were under this study: Hawaii Community Correctional Center (HCCC), Kulani Correctional Facility (KCF), Maui Community Correctional Center (MCCC), Kauai Community Correctional Center (KCCC), Halawa Correctional Facility (HCF), Oahu Community Correctional Center (OCCC), Waiawa Correctional Facility (WCF), and Women's Community Correctional Center (WCCC). The completion of the waste audit provided data for the overall waste operations, waste composition make-up for each site, potential areas to implement a waste management program and barriers to implementation of a waste management program. Through the study and waste audit, the following barriers to implementation of a more sustainable waste management program were found: the need to determine site specific waste composition make-up to act as a benchmark or standard for each site, cost of equipment or budget constraints, understaffing of adult correctional officers (ACO), and ease of implementation.

2.0 METHODS

A waste audit is used to determine the types and quantities of waste that is produced in a given timeframe as well as the barriers to implementation. The interview process of the waste audit was used to determine the barriers to implementation. To determine the quantities of waste the site-specific waste composition make-up procedure was used.

2.1 Waste Audit Procedure

To conduct the waste audit each correctional facility was visited so interviews and observations could be completed. The main sources of waste that were analyzed at each site were: paper, cardboard, plastic, food waste, green waste, bulky waste, and hazardous waste. Interviews with correctional staff and inmate workers were conducted with correctional staff interviews consisting of the following: ACO's, maintenance/facility workers, kitchen supervisors and staff, business supervisors or assistants, chiefs of security, and farm managers. The analyzed waste typically fell under the following three categories: waste operations and cost, currently implemented sustainable programs, and potential recommendations. Specific questions that were used during the interview process can be found in Appendix 1.

2.1.1 Barriers to Implementation Procedure

The barriers to implementation were discovered through the waste audit procedure's interview process. Through the interview questions listed in Appendix 1 correctional staff were able to express their greatest concerns when seeking to implement a waste management program and many common barriers were found.

2.2 Site-Specific Waste Composition Make-up Procedure

To determine the waste quantities the containers that were used to dispose of the waste were quantified by volume and multiplied by the appropriate conversion factors. The total solid waste amount was calculated using two different uncompacted waste density assumptions: 250 and 300 pounds per cubic yard. These densities represent the typical range of values in the industry. For compacted waste, a range of 400 to 700 pounds per cubic yard, was used to find the total solid waste composition. The conversions to quantify the waste quantities were from the U.S. Environmental Protection Agency Volume-to-Weight Conversion Factors (Appendix 2). The total amount of food waste for each site is based on the observed gallons of food waste multiplied 3.8 pounds per gallon. The three facilities with values for corrugated cardboard include KCCC, MCCC, and WCF. These facilities had observed data for cubic yards of corrugated cardboard that could be quantified using 106 pounds per cubic yard. Additionally, MCCC also had observed data for white ledger paper that could be quantified using 465lbs per cubic yard. The yard waste for KCF, KCCC, and WCF have values of zero (0) because their yard waste does not end up in the solid waste stream and does not have observed data that can be quantified. OCCC disposes yard waste with other burnable waste and WCCC disposes yard waste in a designated green waste roll-off bin. The values for the total yard waste were quantified using the observed waste streams for green waste and quantified using 250 pounds per cubic yard. The values calculated in tons per month are bolded in Table 1. Site Specific Waste Composition Make-up.

For those materials without volumetric data, including paper, plastics, metals, and wood, the totals were calculated using the percent breakdown of Florida Correctional Facility Waste Composition. The percentages were used to find the total for the missing values in ton/month. For example, the total solid waste for OCCC is approximately 189 to 327 tons/month and the total food waste is 6.36 tons/month. To determine the percent range of food waste the following method was used:

Method 1.

$$\frac{6.36 \text{ tons/month}}{189 \text{ tons/month}} = 0.03 \rightarrow .03 \times 100 = 3\%$$

$$\frac{6.36 \text{ tons/month}}{327 \text{ tons/month}} = 0.02 \rightarrow .02 \times 100 = 2\%$$

To determine the remaining percentages for OCCC's all paper waste, all plastic waste, all metal waste, all wood waste, and other miscellaneous the following method was used:

Method 2.

How to determine OCCC's All Paper Waste Percentage[1]

	Steps	Using 189 tons/month for OCCC's Total Waste	Using 327 tons/month for OCCC's Total Waste
Step 1.	Add known percentages together for Hawaii Facility	OCCC's Food Waste Percentage + OCCC's Yard Waste Percentage	
		3% + 0.4% = 3.4%	2% + 0.2% = 2.2%
Step 2.	(1-Step 1 Value) (100)	(1-3.4%) (100) = 96.6	(1-2.2%) (100) = 97.8
Step 3.	Add the Florida equivalent percentages	Florida Food Waste Percentage + Florida Yard Waste Percentage	
		31.3% + 1.4% = 32.7%	
Step 4.	[(1) - (Step 3 Value)] (100)	[(1) - (32.7%)] (100) = 67.3	
Step 5.	[(Florida equivalent percentage for the unknown Hawaii facility) (Step 2)] / (Step 4) / (100)	(Florida's All Paper Waste Percentage) (Step 2)/ (Step 4) / (100)	
		[(37.7) (96.6)] / (67.3) / (100) = 54%	[(37.7) (97.8)] / (67.3) / (100) = 55%

[1]Values for this example were rounded to the nearest tenth percent and are not exact

Now that the percentages are known, the ton/month value can be determined by using the following method:

Method 3.

How to Determine OCCC's All Paper Waste in Tons/Month[1]

	Steps	Using 189 tons/month for OCCC's Total Waste	Using 327 tons/month for OCCC's Total Waste
Step 1	(Material Percentage) (Total Solid Waste for Hawaii Facility)	(54%) (189 tons/month) =102 tons/month	(55%) (327 tons/month) = 180 tons/month

[1]The values for this example were rounded to the nearest whole number, they are not exact

3.0 RESULTS

Table 1 illustrates the quantitative results of the waste audit conducted at each of the correctional facilities. It captures the total waste produced for all paper waste, all plastic waste, all metal waste, all food waste, all wood waste, and other miscellaneous waste. HCCC is estimated to produce 16.16 tons/month to 20.04 tons/month paper waste, 3.42 tons/month to 4.20 tons/month of plastic waste, and 3.90 tons/month of food waste, and 1.52 tons/month to 1.86 tons/month of wood waste, and 3.03 tons/month to 3.72 tons/month of other miscellaneous waste. The total waste HCCC produced per tons/month is 33.68 to 40.41 which breaks down to 9.30 to 11.16 pounds/day/inmate.

KCF is estimated to produce 0.20 tons/month to 0.48 tons/month paper waste, 0.04 tons/month to 0.10 tons/month of plastic waste, and 4.13 tons/month of food waste, and 0.02 tons/month to 0.04 tons/month of wood waste, and 0.04 tons/month to 0.09 tons/month of other miscellaneous waste. The total waste KCF produced per tons/month is 4.5 to 5.0 which breaks down to 2.01 to 2.24 pounds/day/inmate.

KCCC is estimated to produce 9.85 tons/month to 11.79 tons/month paper waste with approximately 1.84 tons/month for corrugated cardboard, 2.17 tons/month to 2.69 tons/month of plastic waste, and 1.59 tons/month of food waste, and 0.96 tons/month to 1.15 tons/month of wood waste, and 1.92 tons/month to 2.30 tons/month of other miscellaneous waste. The total waste KCCC produced per tons/month is 19.55 to 23.46 which breaks down to 9.59 to 11.51 pounds/day/inmate.

MCCC is estimated to produce 15.58 tons/month to 17.56 tons/month paper waste with 10.75 tons/month for corrugated cardboard and 0.35 tons/month of white ledger, 1.59 tons/month to 2.33 tons/month of plastic waste, and 1.98 tons/month of food waste, and 0.72 tons/month to 1.03 tons/month of wood waste, and 1.43 tons/month to 2.06 tons/month of other miscellaneous waste. The total waste MCCC produced per tons/month is 23.90 to 28.68 which breaks down to 4.97 to 5.97 pounds/day/inmate.

OCCC is estimated to produce 101.90 tons/month to 179.31 tons/month paper waste, 21.35 tons/month to 37.75 tons/month of plastic waste, and 6.36 tons/month of food waste, and 6.43 tons/month to 10.74 tons/month of wood waste with 0.75 tons/month of yard waste, and 18.93 tons/month to 33.29 tons/month of other miscellaneous waste. The total waste OCCC produced per tons/month is 189.02 to 327.20 which breaks down to 14.67 to 25.40 pounds/day/inmate.

HCF is estimated to produce 22.03 tons/month to 43.73 tons/month paper waste, 4.67 tons/month to 9.16 tons/month of plastic waste, and 11.56 tons/month of food waste, and 2.07 tons/month to 4.06 tons/month of wood waste, and 4.14 tons/month to 8.12 tons/month of other miscellaneous waste. The total waste HCF produced per tons/month is 52.14 to 91.25 which breaks down to 4.32 to 7.56 pounds/day/inmate.

WCF is estimated to produce 27.52 tons/month to 33.00 tons/month paper waste with 2.53 tons/month of corrugated cardboard, 6.76 tons/month to 8.24 tons/month of plastic waste, and 2.28 tons/month of food waste, and 1.80 tons/month to 2.19 tons/month of wood waste, and 5.99 tons/month to 7.30

tons/month of other miscellaneous waste. The total waste WCF produced per tons/month is 55.13 to 66.16 which breaks down to 16.11 to 19.33 pounds/day/inmate.

WCCC is estimated to produce 20.14 tons/month to 28.91 tons/month paper waste, 4.22 tons/month to 6.06 tons/month of plastic waste, and 16.18 tons/month of food waste, and 27.19 tons/month to 27.68 tons/month of wood waste with 26.07 tons/month as yard waste, and 3.74 tons/month to 5.37 tons/month of other miscellaneous waste. The total waste WCCC produced per tons/month is 78.21 to 93.86 which breaks down to 25.46 to 30.55 pounds/day/inmate.

Table 1. Site Specific Waste Composition Make-up

		Hawaii Island				Kauai		Maui		Oahu							
Material Categories	Florida	HCCC		KCF		KCCC		MCCC		OCCC		HCF		WCF		WCCC	
Newspaper	4.2%																
Corrugated Cardboard	8.5%					**1.84**		**10.75**						**2.53**			
White Ledger	7.3%							**0.35**									
Other Mixed Paper	7.8%																
Non-recyclable Paper	8.5%																
Gable-top Containers	1.4%																
All Paper Waste	**37.7%**	16.17	20.04	0.20	0.48	9.85	11.79	15.58	17.56	101.90	179.31	22.03	43.73	27.52	33.00	20.14	28.91
PET Containers	0.4%																
Natural HDPE Containers	0.2%																
Pigmented HDPE Containers	0.2%																
Polystyrene Plastic	1.0%																
Other Plastic Bottles/Containers	0.4%																
Other Plastic	5.7%																
All Plastics Waste	**7.90%**	3.42	4.20	0.04	0.10	2.17	2.69	1.59	2.33	21.35	37.57	4.67	9.16	6.76	8.24	4.22	6.06
Tin/Steel Cans	1.4%																
Aluminum Cans	0.5%																
Other Ferrous/Nonferrous Metal	8.0%																
All Metal Waste	**9.90%**	4.29	5.26	0.05	0.13	2.72	3.37	2.02	2.92	26.76	47.09	5.85	11.48	8.47	10.33	5.29	7.59
Glass	0.2%																
Textiles	1.5%																
Electronics	0.5%																

Compostable Food Waste	30.4%																
Non-compostable Food Waste	0.9%																
All Food Waste	**31.30%**	**3.90**		**4.13**		**1.59**		**1.98**		**6.36**		**11.56**		**2.28**		**16.18**	
C&D Debris	0.8%																
Wood Waste	1.3%																
Yard Waste	1.4%			**0.00**		**0.00**				**0.75**				**0.00**		**26.07**	
All Wood Waste	3.50%	1.52	1.86	0.02	0.04	0.96	1.15	0.72	1.03	6.43	10.74	2.07	4.06	1.80	2.19	27.19	27.68
Other Miscellaneous	**7.0%**	3.03	3.72	0.04	0.09	1.92	2.30	1.43	2.06	18.92	33.29	4.14	8.12	5.99	7.30	3.74	5.37

Total (ton/month)	**100%**	33.68	40.41	4.5	5.00	19.55	23.46	23.90	28.68	189.02	327.20	52.14	91.25	55.13	66.16	78.21	93.86
Total (pound/day/inmate)		9.30	11.16	2.01	2.24	9.59	11.51	4.97	5.97	14.67	25.40	4.32	7.56	16.11	19.33	25.46	30.55

The total waste per inmate per day was estimated using the inmate population (inmate population at time of the respective site visit) divided by the converted value to pounds of total solid waste per day for each facility. An Environmental Assessments completed by Louis Berger Group, Inc. in 2008 and 2018-2020 valued the total waste per inmate per day as 2 pounds/day for males and 4 pounds/day for females. However, in this study the only calculated average for total waste per day per inmate (Table 2) that is comparable to the values that were assumed in the prior Environmental Assessments was for KCF. According to the Environmental Protection Agency (EPA) after gathering data for over 35 years, they determined an individual produces 4.9 pounds of municipal waste per day (National Overview: Facts and Figures on Materials, Wastes and Recycling, 2021). This is similar to the amount of waste estimated for the inmates at HFC and MCCC. The inmates at HCF, on average produce 5.94 pounds/day and the inmates at MCCC produce on average 5.97 pounds/day. The women at WCCC produced the most waste per day with 28.01 pounds/day, HCCC and KCCC had similar values of 10.23 and 10.55 pounds/ day, respectively. Lastly, WCF had a high value of 17.72 pounds/day. One of the reasons why WCF may have an abnormally high average amount of solid waste produced per inmate is the need to have waste bins spread throughout the entire facility due to the availability of ACO's to supervise inmates as they throw waste away. During the site visit at WCF, facility staff estimated that trash bins were typically 75% to 100% full at the time of pick-up and 87.5% capacity was used to determine the total solid waste produced. However, it is likely that the percentage is overestimated.

Table 2. Estimated Average of Total Waste Produced per Inmate per Day at each Facility

Facility	Inmate Population (taken at time of site visit)		Average (lb/inmate/day)
	Male	Female	
HCCC (Hawaii Island)	217	21	10.23
KCF (Hawaii Island)	147	0	2.12
KCCC (Kauai)	112	22	10.55
MCCC (Maui)	271	45	5.47
OCCC (Oahu)	749	101	20.04
HCF (Oahu)	794	0	5.94
WCF (Oahu)	225	0	17.72
WCCC (Oahu)	0	202	28.01
EPA National AVG	N/A	N/A	4.9
Environmental Assessment (Louis Berger Group, Inc.) - WOMEN	N/A	N/A	4
Environmental Assessment (Louis Berger Group, Inc.) - MEN	N/A	N/A	2

Table 3 illustrated the estimated ranges of percent breakdown for solid waste composition at each facility. It also compares a facility wide average to the state average and the EPA average. The data shows that facility average for paper is nearly twice as much at 42% compared to the state average and EPA average at 22.7% and 23.05% respectively. Most of the paper waste observed was packaging material used to deliver food supplies and other necessities for the inmates. A reason for correctional facilities having twice as much paper waste compared to the State or EPA average is that a typical individual does not receive their food or necessities in boxes and are also not typically purchased in bulk.

The average metal waste produced for the correctional facilities is 10% while the State average is less than half at 4.6%. However, the EPA average is like the correctional facility average with a value of 8.76%. The average for all plastic waste is relatively similar for the correctional facilities, State, and EPA average. However, the State and EPA averages for all organic waste is similar at 35.5% and 39.89% while the correctional facility average is 28%.

There are several correctional facilities that have a significantly different waste composition compared to the majority of the facilities. For example, most of KCF's waste comes from food waste (83%-92%) while they produce very little in every other material category including paper (5%-10%). KCF has a farming program that provides produce for the inmates which would reduce the amount of packaging materials needed for food supplies. Meanwhile, OCCC and WCF has significantly lower food waste percentages at 2-3 and 34 percent, respectively. OCCC's kitchen manager has developed a system that understands the typical amount of food consumed by an inmate depending on what meal is being served. This allows for very minimal food waste produced. WCCC has significantly higher wood waste production (29% to 35%) compared to the remaining facilities. One reason to account for a large wood waste composition is that WCCC has a larger number of grassy areas than the other facilities. This facility has multiple designated green to account for all the waste production while some facilities don't have a green bin or one at most.

Table 3. Estimated Ranges of Percent Breakdown for Solid Waste Composition at each Facility

	Hawaii Island		Kauai	Maui	Oahu				Facility	State	EPA
	HCCC	KCF	KCCC	MCCC	OCCC	HCF	WCF	WCCC	AVG	AVG	AVG
Material Category	Percent (%)										
All Paper Waste	48 - 50	5 - 10	50	61 - 65	54 - 55	42 - 48	50	26 - 31	42	22.7	23.05
All Plastic Waste	10	1 - 2	11	7 - 8	11	9 - 10	12	5 - 6	8	9.8	12.2
All Metal Waste	13	1 - 3	14	8 - 10	14	11 - 13	15 - 16	7 - 8	10	4.6	8.76
All Food Waste	10 - 12	83 - 92	7 - 8	7 - 8	2 - 3	13 - 22	3 - 4	17 - 21	20	35.5	21.59
All Wood Waste	5	.4 - 1	5	3 - 4	3	4	3	29 - 35	8		18.3
Other Miscellaneous	9	1 - 2	10	6 - 7	10	8 - 9	11	5 - 6	7	10.4	

Table 4 illustrates the barriers to implementation and the number of correctional facilities that mentioned those barriers in the interview process. All 8 of the correctional facilities had mentioned that cost of equipment or budget constraints, understaffing of ACO's, understaffing of personnel with knowledge/experience, security, and ease of implementation were all barriers to implementation of a new waste management program or expansion of a current program. Two facilities mentioned that their current programs have since been scaled down due to budget constraints and lack of ACO supervision which then also turned into a security risk. The facilities also shared that the greatest set back to their facility expanding their current waste management program is additional funding to support expansion. One facility noted that they were lacking the personnel with the knowledge and experience to make the current program successful. The current staffing there has some knowledge through learning channels such as YouTube or google. The final barrier to Hawaii's correctional facilities implementing a fully functioning waste management plan is the lack of national data and no site-specific waste composition make-up data on each of the sites in this study. It was discussed with the Department of Public Safety

(PSD) that a waste audit would need to be conducted at each of the sites and this included speaking and interviewing correctional staff.

Table 4. Barriers to Implementation

	Response from Correctional Facility	%
Site specific waste composition make-up	0	0
Cost of equipment or budget constraints	8	100
Understaffing of ACO's	8	100
Understaffing of personnel with knowledge/experience	7	87.5
Security	8	100
Ease of Implementation	8	100

4.0 DISCUSSION

The combined data demonstrates five findings that could potentially eliminate or mitigate the barriers to implementation. Together, the waste audit and data gathered through field visits completed through February 2021 through August 2021, interviews with staff, and Environmental Assessments completed by Louis Berger Group, Inc., and research on programs that have implemented a successful waste management program support the potential efficacy of these approaches. The 5 findings include: leadership support, policy changes, rating tool, training and education, cost savings and revenue.

4.1 Leadership Support

The primary method to eliminate or reduce barriers to implementation is leadership support. This includes the administration of PSD and the correctional facility itself. The leadership team can prioritize implementation of a waste management program or expansion and designate funds to do so. Correctional facilities that have successful waste management programs in place attribute their success to having a leadership team that supports the program and is recognizant of its importance (Ulrich, C., & Nadkarni, N. M. 2009). The leadership team prioritizing the waste management program will help to overcome barriers such as budget constraints, understaffing issues with ACO's and personnel with the necessary knowledge and experience.

The state of Hawaii has implemented several ordinances to help divert or decrease commercial and residential waste from ending up in a landfill or incineration. By 2030, the city's goal is to reduce pounds of waste per person per day to 4.9 pounds (Padre, Pitzler, Schwing, 2019). In Revised Ordinances of Honolulu (ROH) Section 9-1.7, the city banned the disposal of green waste from all commercial generators. Additionally, waste being delivered to H-Power is only allowed to contain 10% or less of green waste or cardboard with further restrictions expected to follow in upcoming years. In a more recent ordinance ROH 19-30, all Hawaiian Islands have banned the use of single-use plastic. The current waste management program in place at certain facilities are not meeting, some of the requirements for these ordinances. This can be a motivating factor when trying to gain leadership support and making it easier to implement a new waste management program.

4.2 Policy Changes

A motivating factor for correctional facility staff and the leadership team is being able to reinvest any revenue that may come from the program. However, the current policy in place requires any revenue to be paid to the state of Hawaii's general funds. To change this policy, a bill must be drafted requesting that revenue from the waste management program be given back to the specific correctional facility while simultaneously advocating legislative support from representatives and senators. By having the funds returned to the facility any initial and operating costs that the program has can be made back addressing the cost of equipment and budget constraints.

4.3 Scorecard Matrix Tool

In order to place priority for certain projects that each correctional facility under this study should implement, the project should be analyzed using the scorecard matrix tool. The scorecard matrix tool (Appendix 3) is broken up into four categories: economic benefit, security benefit, social benefit, and environmental benefit. The categories are then subdivided, and the project is given a score based on the criteria of the subsection. The total score is out of 100. Correctional facility officials can use the scores to place priority on a recommended waste management project. For example, if a project requires ACO supervision where there might be a shortage, personnel with the necessary knowledge to conduct the program, or funds to get the program started, the score a project receives through the scorecard matrix tool will help to justify the expense of implementing the program. If the program is justified through a very meticulous analysis, correctional facility officials may also be more inclined to support the program and help ensure its success.

4.4 Training and Education

Correctional facilities that have successfully implemented waste management programs, focus on training and classes for staff. A common barrier to implementation of a waste management program is a lack of knowledgeable personnel, it is crucial to provide the necessary training for staff that will be involved in the newly implemented waste management program. Depending on the skill level required by the inmates, classes can be held by correctional staff or an outside representative. Cedar Creek Correctional Center (CCCC) in Washington State implemented an educational course series that was open for both correctional staff and inmates to attend. In surveys given at the conclusion of the series, both correctional staff and inmates expressed their interest in the lectures and even requested more speakers on particular topics. Correctional staff at CCCC encourage officials from other facilities to attend the lectures as well. Providing educational opportunities for inmates and correctional staff on topics such as sustainability, ecology, environmental health, and the nature of learning, will help them to understand the importance of a waste management program (Ulrich, C., & Nadkarni, N. M. 2009). This increased knowledge, understanding and expertise within the facility can help make it easier to implement a waste management program. Training and certificates can also provide inmates with job opportunities once they are released.

According to the 2010 census, Native Hawaiians/Pacific Islanders represented 39% of the prison and jail population but only represents 10% of the state's population (Prison Policy Initiative, 2021). It is critical to connect people of Native Hawaiian ancestry to their culture and the land. In addition to classes that explain topics on sustainability and environmental health, lectures to explain the mo'olelo (history) of the land will help them with their connection and finding importance in what they do. To continue to

target the dominant prison population and help promote sustainability for Hawaii, native plants and cultural practices can be integrated at Hawaii's correctional facilities into the recommended sustainable technologies or programs that aim to reduce waste.

4.5 Cost Savings and Revenue

Many correctional facilities that have implemented waste management programs have seen a savings or revenue increase. For example, Theo Lacy Facility has implemented a waste management program that composts food waste, reuses/repurposes textiles, recycles cardboard, metal food cans, milk cartons, brown paper bags and newspaper and has seen a $50,000 yearly savings on waste hauling expenses and $18,000 in yearly revenue from recycling. The Georgia Department of Corrections implemented food and green waste composting across 9 facilities and saw a savings of $198,960 in waste diversions as well as $455,620 in yearly revenue from finished compost. Each of the participating facilities in Washington State Department of Corrections that composts food waste and biosolids saw a $30,000 yearly average on avoided tipping fees (Smith-Sebasto, 2016). Although there might be a small start-up cost to begin a composting or recycling program, the savings and possible revenue from the program can be put towards those expenses until the return on investment is achieved. Many correctional facilities have stated they used any revenue to reinvest in the waste management program to either repair or maintain equipment or to expand the program (Smith-Sebasto, 2016).

5.0 CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

Correctional facilities should implement a waste management program that will reduce the financial and human capital costs of the facility by engaging inmates in hands-on experiences, education, and training to prepare them for jobs upon their release. Other correctional facilities may come across similar barriers to entry for implementing waste management programs as the correctional facilities under this study. Those barriers include site specific waste composition make-up, cost of equipment or budget constraints, understaffing of ACO's, understaffing of personnel with knowledge/experience, security, and ease of implementation. Through the waste audit and data gathered through field visits completed through February 2021 through August 2021, interviews with staff, Environmental Assessments completed by Louis Berger Group, Inc., and research on programs that have implemented a successful waste management program came 5 findings that could potentially eliminate or lessen the impact of the barriers to implementation which include: leadership support, policy changes, rating tool, training and education, cost savings and revenue. Through this study the biggest takeaways are:

- National or state averages for waste composition make-up and waste produced per day could be greatly different compared to the correctional facility
- Correctional facilities with successful waste management programs have primarily implemented recycling and material reuse.
- Correctional staff involved in the interview process expressed they understood the importance of implementing a waste management program or making it a priority.
- Revenue from revenue produced by the correctional facility does not currently benefit the facility but instead gets put into Hawaii's general fund.

- Only three (KCF, MCCC, HCF) of the Hawaii's Correctional Facilities are producing pounds of waste per day per person similar or less than that of the EPA's national average.
- WCCC has the greatest pounds of waste per inmate per day at 28.01 pounds, which is approximately 571% greater than the EPA national average.
- KCF has the lowest pounds of waste per inmate per day at 2.12 pounds, which is approximately 43% less than the EPA national average.
- The top three average waste produced for all Hawaii correctional facilities is paper waste at 42%, organic waste (food and wood waste) at 28%, followed by metal waste at 10%.
- KCF is Hawaii's only correctional facility that has a designated position (farm manager) to oversee their sustainability program.

This study was conducted during the COVID-19 Pandemic and led to above average spending on single use items needed to minimize the spread of the virus. This is a limitation because the increase in purchases of single use items and certain food items had a domino effect and led to an increase in certain waste that might not reflect the typical amount. Another limitation of this study was the security risk of being able to interview inmates. Inmate interviews would have provided insights on potential inmate participation and interest for the waste management program. Hawaii's waste composition make-up used Florida's percent composition to estimate the unknown quantities. This is a limitation as the proportions used could be an inaccurate representation of the true waste amount for the Hawaii site.

5.2 Recommendations

This study has provided the necessary framework to allow for Hawaii correctional facility officials to further their steps in being able to successfully implement or expand a waste management program at each site. The analysis of this study can also be applied to other analogous correctional facilities but are not limited to other institutions that face similar barriers of entry when looking to implement or expand a waste management program at any scale. Some of the recommendations for Hawaii correctional facilities include:

- Conduct a waste audit to learn about the types and quantities of waste produced as well as any current waste management programs in place
- Hawaii correctional facilities should look first into targeting their top three waste (paper waste, organic waste, and metal waste) produced and implementing recycling, composting or material reuse as their primary avenue to reduce waste.
- Used cooking oil should be recycled into biodiesel and used as fuel for facility vehicles and machinery.
- Provide training and education for current and future employees that are overseeing the implemented waste management program
- Develop a bill that would allow any revenue made by the correctional facility to be put back into the facility
- KCF farm manager can provide training to other correctional facility staff members at the other sites and provide guidance when starting programs
- Seek grants that could provide additional funding to implement or expand current programs
- Seek partnerships with institutions to provide green jobs for inmates upon their release

- Waste make-up composition for each correctional facility should be used as a baseline to measure the success or impact of the waste management program.
- HCCC and KCCC should seek to reduce their pounds of waste per day per inmate by nearly half by 2030 to be comparable to the EPA national average and meet the Hawaii's city and county goal to achieve a similar value.
- OCCC and WCF should seek to reduce their pounds of waste per day per inmate by nearly 75% by 2030 to be comparable to the EPA national average meet the Hawaii's city and county goal to achieve a similar value.
- WCCC should seek to reduce their pounds of waste per day per inmate by almost 85% by 2030 to be comparable to the EPA national average meet the Hawaii's city and county goal to achieve a similar value.

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7.0 APPENDIX

Appendix 1. Interview Questions

Waste operations and cost

1. How many roll-off containers are designated for municipal waste, green waste and cardboard?
2. How often are the roll-off containers emptied and on average how full are the containers?
3. Who is contracted for waste disposal?
4. What is the cost for waste disposal?
5. If there are no separate roll-off containers for green waste and cardboard, how is green waste or cardboard disposed of?

Currently implemented sustainable programs

1. What are the current sustainable programs in place?
2. Who is involved in ensuring the success of the program?
3. What is needed to expand the program?

Potential recommendations

1. What is a new program that the facility would benefit from regarding waste management?
2. What does this program need to be implemented?
3. What are some ways to meet those needs?

Appendix 2. Volume-to-Weight Conversion Factors

Yard Trimmings	Yard Trimmings			
	Leaves	cubic yard	250-500	1
	Leaves (Minnesota)	cubic yard	300 - 383	15
	Mixed Yard Waste			
	Uncompacted	cubic yard	250	1
	Compacted	cubic yard	640	1
	Prunings & Trimmings	cubic yard	127	6
	Branches & Stumps	cubic yard	127	6
Municipal Solid Waste	MSW - Commercial			
	Commercial - dry waste	cubic yard	56-73	16, 8
	Commercial - all waste, uncompacted	cubic yard	138	21
	Mixed MSW - Residential, Institutional, Commercial			
	Uncompacted	cubic yard	250-300	14
	Compacted	cubic yard	400-700	14
	Mixed MSW - Multifamily uncompacted	cubic yard	95	21
	MSW - Landfill			
	Compacted - MSW Small Landfill with Best Management Practices	cubic yard	1,200-1,700	17
	Compacted - MSW Large Landfill with Best Management Practices	cubic yard	1,700-2,000	17

Paper	Newsprint			
	Loose	cubic yard	360-800	1
	Baled	cubic yard	750-1,000	10
	Books - paperback, loose	cubic yard	428	23
	Old Corrugated Containers			
	Flattened	cubic yard	106	4
	Baled	cubic yard	700-1,100	10
	Old Corrugated Containers and Chip Board			
	Uncompacted	cubic yard	74.54	4
	Office Paper			
	Computer Paper			
	Loose	cubic yard	375-465	1
	Compacted/Baled	cubic yard	755-925	1
	Mixed			
	Loose	cubic yard	110-380	1
	Loose	cubic yard	323	4
	Compacted	cubic yard	610-755	1
	Shredded	cubic yard	128	4
	Mixed Baled	cubic yard	1,000-1,200	10
	Miscellaneous			
	Cartons (milk and juice) uncrushed	cubic yard	50	7

Food				
	Fats, Oils, Grease	55-gallon	412	2
	Organics - commercial	cubic yard	135	21
	Source Separated Organics - commercial	cubic yard	1,000	15
	Food Waste - restaurants	cubic yard	396	21
	Food Waste	cubic yard	463	4
	Food Waste	cubic foot	22-45	4
	Food waste - university	gallon	3.8	22
	Food Waste	64 gallon toter	150	4
	Food waste	2 cubic yard full towable	2,736	4

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Appendix 3. Scorecard Matrix Tool

PILLAR:	CRITERIA CATEGORY:	CRITERIA POINTS:	PILLAR WEIGHT:	CRITERIA CONTRIB TO TOTAL SCORE:	SUSTAINABILITY INITIATIVE EVALUATION QUESTION:	SCORING SYSTEM (see individual criteria):			
Economic Benefits:		**100**	**35%**						
1.1	Simple ROI	25		8.8%	How many months (payback period) does it take for the improvement to pay for itself?	**0:** doesn't provide positive return within 10 years	**25:** payback 5-10 years	**50:** payback 2-5 years	**100:** payback <2 year
1.2	Operational Savings	15		5.3%	What is the projected $ value of the savings (annualized)?	**0:** doesn't produce cost savings	**25:** annual savings $1-50,000	**50:** annual savings $50,000-500,000	**100:** annual savings over $500,000
1.3	Revenue Generation	20		7.0%	How much revenue does the initiative generate?	**0:** doesn't produce revenue	**25:** annual revenue $1-20,000	**50:** annual revenue $20,000-100,000	**100:** annual revenue over $100,000
1.4	Societal Savings	15		5.3%	How much economic benefit is created external to PSD?	**0:** No impact outside of PSD	**25:** annual impact $1-50,000	**50:** annual impact $50,000-250,000	**100:** annual impact over $250,000
1.5	Capacity Creation	10		3.5%	Does the initiative increase functional capacity of the staff or facility to be used to support alternative functions?	**0:** doesn't free up resources	**25:** frees up resouces valued at $1-50,000	**50:** frees up resouces valued at $50,000-150,000	**100:** frees up resouces valued at over $150,000
1.6	External Funds	10		3.5%	Does the improvement utilize external funding allowing PSD to accomplish SSMP goals without securing more money?	**0:** No additional funding	**25:** annual funding $1-50,000	**50:** annual funding $50,000-500,000	**100:** annual funding over $500,000
1.7	Maintenance Level	5		1.8%	What is the intuitive assumption of maintenance level required?	**0:** requires additional maintenance contract or internal staff	**33:** requires additional maintenance cost added to existing contracts	**66:** additional maintenance required can be performed within current maintenace budget	**100:** doesn't require additional maintenance

PILLAR:	CRITERIA CATEGORY:	CRITERIA POINTS:	PILLAR WEIGHT:	CRITERIA CONTRIB TO TOTAL SCORE:	SUSTAINABILITY INITIATIVE EVALUATION QUESTION:	SCORING SYSTEM (see individual criteria):			
Security Benefits:		**100**	**30%**	30.0%					
2.1	Facility Standards	30		9.0%	Does the improvement help the facility to maintain accreditation and any internal policies or standards to make the facility	**0:** No	**100:** Yes		
2.2	Staff Risk	20		6.0%	Does it reduce perceived risks understood by PSD staff; or said in other words, does it increase the possibility of redirecting or "correcting" AIC behavior to	**0:** No	**100:** Yes		
2.3	AIC Risk	20		6.0%	Does it reduce perceived risks understood by AIC's; or said in other words, does it increase the possibility of enhancing safety for	**0:** No	**100:** Yes		
2.4	Responsive action	15		4.5%	Does it respond to a call for action by either the community, the oversite committee or other authority having jurisdiction over PSD?	**0:** No	**100:** Yes		
2.5	Facility Upgrade	15		4.5%	Does it accomplish a known need of the facility that directly impacts safety and security in a positive way?	**0:** No	**100:** Yes		

PILLAR:	CRITERIA CATEGORY:	CRITERIA POINTS:	PILLAR WEIGHT:	CRITERIA CONTRIB TO TOTAL SCORE :	SUSTAINABILITY INITIATIVE EVALUATION QUESTION:	SCORING SYSTEM (see individual criteria):			
Social Benefits:		**100**	**20%**	20.0%					
3.1	Enhanced Education	15		3.0%	Does it create opportunities for either occupational or non-occupational educational and/or personal development for AIC's?	**0:** No	**80:** Yes, not formal or accredited education	**100:** Yes, formal or accredited education	
3.2	Health Enhancement	15		3.0%	Does it address a specific credit or initiative within the WELL building program?	**0:** No	**100:** Yes		
3.3	Indoor Environment	15		3.0%	Does the improvement impact occupant air quality, thermal comfort and/or daylighting/views etc.?	**0:** No	**100:** Yes		
3.4	Job Creation	15		3.0%	Does it create meaningful activity for the AIC to replace idleness	**0:** No	**100:** Yes		
3.5	Cultural Connection	15		3.0%	Does it increase cultural awareness cultural connection to AIC's in custody that can inspire	**0:** No	**100:** Yes		
3.6	Community Inclusion	15		3.0%	Does the initiative broaden and improve the facilities connection to the community outside of Prison	**0:** No	**100:** Yes		
3.7	Public Perception	10		2.0%	Does the improvement increase public perception of PSD taking action to be more environmentally sustainable and rehabilitative?	**0:** No	**100:** Yes		

PILLAR:	CRITERIA CATEGORY:	CRITERIA POINTS:	PILLAR WEIGHT:	CRITERIA CONTRIB TO TOTAL SCORE:	SUSTAINABILITY INITIATIVE EVALUATION QUESTION:	SCORING SYSTEM (see individual criteria):			
Environmental Benefits:		**100**	**15%**	15.0%					
4.1	Carbon Reduction	25		3.8%	What is the overall carbon footprint reduction of the initiative?	**0:** No impact on carbon reduction	**25:** 1-40% carbon reduction	**50:** 41-80% carbon reduction	**100:** 81-100% carbon reduction
4.2	Resource Conservation	25		3.8%	Does the initiative have a measurable impact to resource conservation?	**0:** No impact on conservation	**25:** conservation impact on **one** resource (natural/native features, environmental impact, local materials, etc.)	**50:** conservation impact on **two** resources (natural/native features, environmental impact, local materials, etc.)	**100:** conservation impact on **three or more** resources (natural/native features, environmental impact, local materials, etc.)
4.3	Waste Reduction	20		3.0%	Does the initiative have a measurable impact on waste	**0:** No	**100:** Yes		
4.4	Food Generation	10		1.5%	Does the initiative directly produce food?	**0:** No	**100:** Yes		
4.5	Renewable Energy	10		1.5%	Does the initiative generate renewable energy sources?	**0:** No	**100:** Yes		
4.6	Environmental Connection	10		1.5%	Does the initiative address nature deficit disorder or generally enhance human nature	**0:** No	**100:** Yes		